JANUARY 1961 3/6

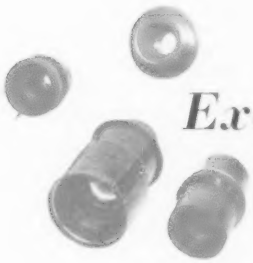
AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS

Computer Communications

Casing the factory

The need for honest serving men



Exclusively for lenses

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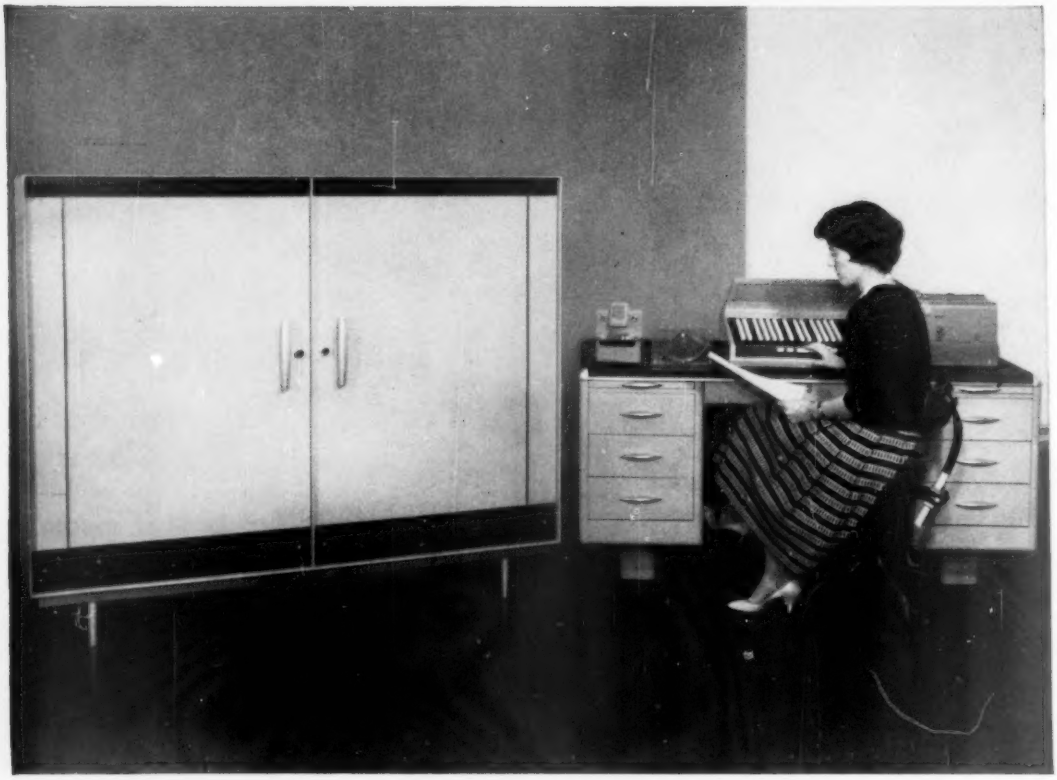

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ELLIOTT

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AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS

VOL 3 No 1

JANUARY 1961

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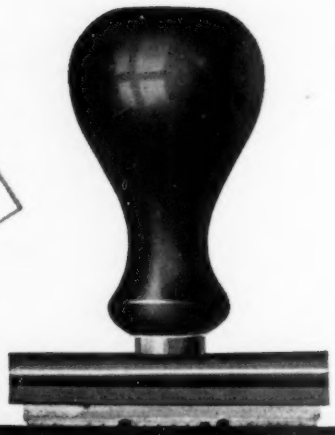

Anyone who thinks that these are just three more computers is a generation behind. For these three EMIDEC machines are the first of a generation of computers new both in concept and technique. In concept, because they were designed from the start to supply management with a full decision-aiding system; in technique, because they embody transistors and technical advances not previously available. These are the computers of the 1960's.

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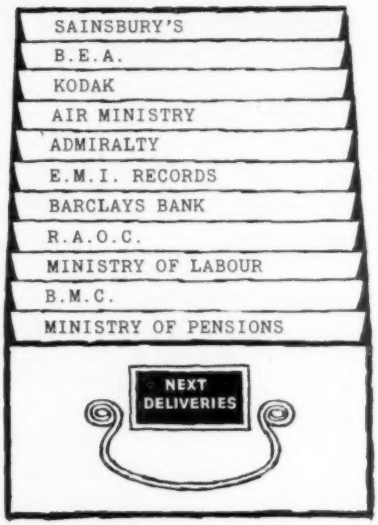

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EE 137

Success Story Delayed

ANOTHER year. Hair a little thinner now—an occupational loss induced by too many yes/no decisions during 1960?—but the holiday brochures have arrived to cheer. A quick glance backwards to see if all those things promised for 1960 happened, then resolutions for other people to keep during the next 12 months—or perhaps not . . .

They ended the year with nice fat order books—that is, some computer manufacturers did, which means that during this year and next there will be a lot more installations on the ground, and there will be more experience to share around—that's the theory, anyway.

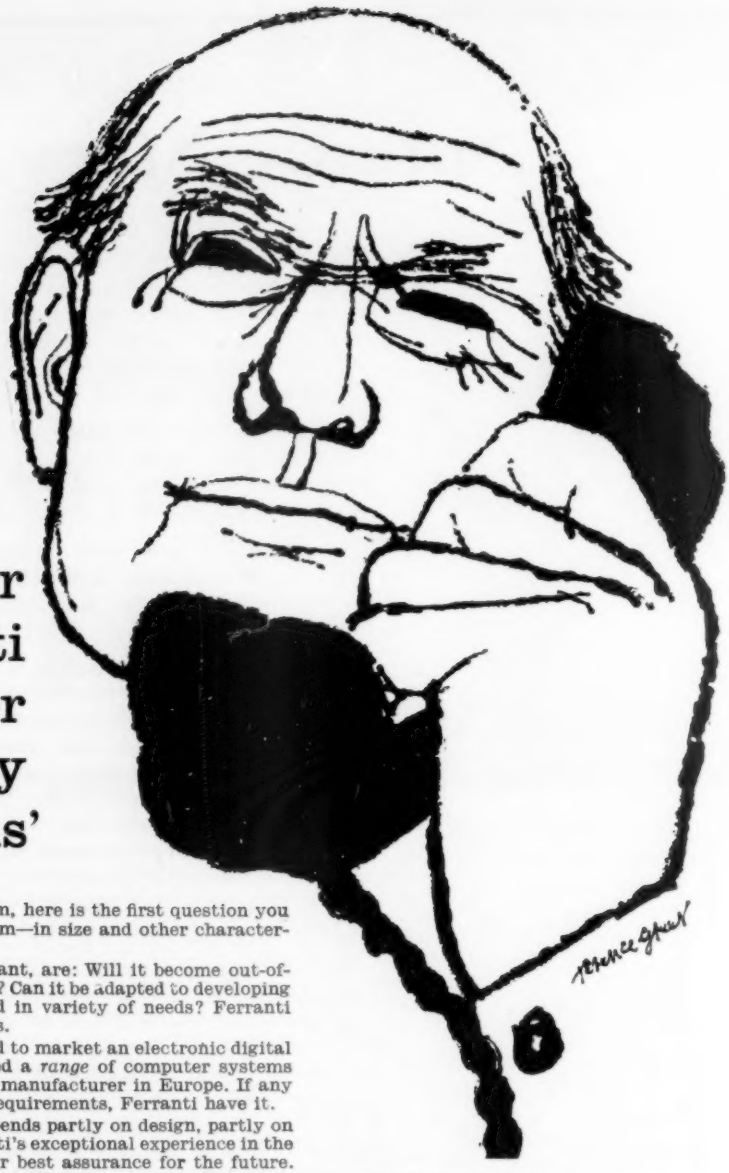
Of the installations now under way—mostly first generation machines—most of them either don't wish to be visited just yet or are not worth braving British Railways to visit. So what's amiss—or has been?

Suppose we probe the ground a little deeper with an example. In March, 1959, one company took delivery of a computer, envisaging that it would put some 80,000 customers' accounts on to the system, update them and do all the usual sales analysis tricks possible. During the summer of 1959 the company was visited with a view to preparing an article on their achievements—but at that time it was understandably still early days: only a section of the accounts had been put on to the system, so it was decided to wait until more work was being undertaken rather than publish a futuristic article . . . January, 1961, the company have asked to be excused a little while until they are running all their accounts on the computer.

So it has taken two years to shift the work on to the machine. Let's spell this out a little: 'when a machine is ordered somebody at chief accountant level works at what it will cost each month just to have it sitting there in a reinforced, air-conditioned room. If it does the data processing work planned for it, the accountant reckons, it will be paying its way because it replaces more expensive methods. If the machine is only partly utilised the payoff is much later than expected. Add to that normal casualty costs (due to inadequate or incomplete systems work, reprogramming, etc) that can occur, and you can write off—for the time being, at least—your success story.

* * *

Next month AUTOMATIC DATA PROCESSING will initiate two new series: the first is a survey of the data processing problems of the insurance industry as a whole, and reviews the solutions various insurance companies are to adopt, which suggest courses and lessons for companies outside the industry. 'Selling automatic data processing equipment in the 1960s' is the theme of the second series, which examines what the salesmen who will come knocking on the doors during the year really have to offer, apart from talk.



'our Ferranti computer certainly helped us'

When choosing a computer system, here is the first question you should ask: Is this the right system—in size and other characteristics—for the job it has to do?

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DATA DIGEST

News of the month at a glance

Delivering the soap

End of a five-year investigation

By the end of this year Colgate-Palmolive Ltd, the soap, detergent and toilet preparations firm, will—if EMI are faithful to their promises—instal an Emidec 1100 computer, and immediately start preparing invoices for their 80,000 customers on the machine.

Colgate supply their customers from stock, and propose to invoice customers before effecting deliveries and to use the invoice information to obtain tighter control on stocks: stock positions of all the lines held at regional warehouses will be computed after each invoice run (and *after* allowance has been made for fulfilling orders). And earlier information on stock positions in the warehouses will make it possible to transfer required quantities of products between factory and warehouse during the night to replenish stocks.

This procedure will produce, it is anticipated, substantial reductions in stocks held without impairing deliveries of products.

By allocating to all customers route numbers (that refer to the 'milkman's rounds' Colgate's lorries make) the company intend to prepare on their computer load sheets for every vehicle, which will ensure that Colgate's transport is efficiently used.

Colgate, who spent five years studying the use of computers for business data processing before taking the jump, say that in addition to sales invoicing, stock control and vehicle loading, initial applications for their machine will include customer accounting, the preparation of monthly statements of account, daily summaries of orders and analyses of sales.

Other applications for the machine are envisaged, but these —belonging to the nebulous future —are unspecified.

Solutions by post

Put that in your pipe . . .

For some time now English Electric's computing bureaux in Kidsgrove, Staffs, and Kingsway, London, have been running a postal computing service. The service has just supplied an answer to its thousandth problem on the design of pipe systems.

Pipe design problems have concerned complicated systems of pipelines intended for carrying gases and liquids at high temperatures and pressures in such installations as refineries and chemical plants, and heat exchangers for nuclear and conventional power systems.

Designs have to take into account stresses and distortions due to high temperatures and pressures, and pipe stress calculations involve a great deal of laborious calculation, and only comparatively simple configurations can be calculated by hand.

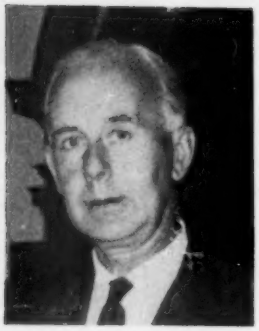
The use of digital computers has changed the outlook on this problem. The repetition involved in flexibility calculations, first for individual pipe sections, and at a later stage for whole branches means the computer is an ideal tool. More rigorous methods of analysis are possible, and stressing of complicated multi-anchor systems can be swiftly accomplished.

BCAC re-formed

To put objects into effect

Last month, Sir Walter Puckey, new chairman of the British Conference on Automation and Computation, lunched senior permanent officials from the 32 member organisations of the conference, then outlined what the recent reconstitution of the conference implied.

Formerly the BCAC operated as a federation of three separate groups concerned respectively with (1) the Engineering Applications of



PUCKEY
Objects recalled

Automation, (2) Automatic Control and Computation and (3) Sociological and Economic Aspects, whereas the three groups have now been merged. (The three aspects will continue to carry equal weight in BCAC's activities.)

Sir Walter recalled the objects of the council—generally, to foster the development and applications of automatic control and computations, co-ordinate activities, where possible, of member organisations and see the flag is carried at international conferences—and intimated the council had set up three panels to further its aims: one on education and training, one on research and development and one for public relations; and reported that a conference would be held in Harrogate from June 27 to 30, with the title 'Automation—Men and Money.'

Plans were also in hand for the delivery, in the autumn, of the first BCAC annual lecture which would be an authoritative review, by an expert in the field, of the present position and probable future development of automatic procedures in British industry and commerce.

Their own medicine

EMI deliver—to EMI

Late last November yet another crane was hired to lift a computer through a hole into a London building. The machine—an Emidec 1100—was delivered to EMI House in Manchester Square, and already it has begun to take over work for EMI Records Ltd. The machine will be used to prepare daily nearly 3,000 invoices for sales of a range of nearly 12,000 different gramophone record titles. Controlling stocks of records, calculating artists' and copyright royalties, producing a payroll and preparing statistics are among the other applications planned for this system.

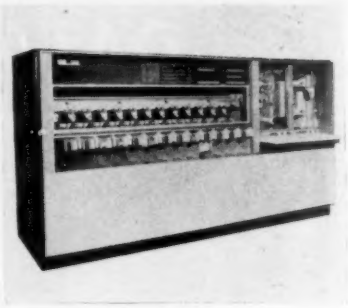
Of the computer manufacturers it can be said that a number do take their own medicine—English Electric, for example, use three or four Deuce machines for their own scientific and technical calculation work—but one area in which the maxim of the cobbler's children being the last to be shod seems to hold true is that of data processing. Apart from one company that has undertaken to do a limited amount of production control work on one of its own machines, there is no evidence that computer manufacturers use computers for their own data processing work—one large company will in fact be installing a rival's machine—though in fairness at least two companies have announced that they will eventually make use of their own machines for this kind of work.

Barclays order

Sorting out a sorter

Following on last month's announcement that the London clearing banks had settled for the E-13B code for magnetic ink character recognition, Barclays Bank announce that they will shortly take delivery of their first cheque sorting machine—this will be an IBM 1210 sorter-reader which will be rented and used for extensive trials as a preliminary step toward automating Barclays' clearing department which has to sort up to a million Barclays' cheques a day. The 1210 machine sorts cheques at the rate of 950 cheques a minute.

Barclays were the first of the London clearing banks to order a computer: in August, 1959, they



SORTER
For extensive trials

put down for an Emidec 1100 which is to be delivered by the middle of this year. The machine will be used to undertake centralised accounting for a group of branches in London—it will keep track of some 40,000 customer accounts.

Vetting results

Senate House to use computer

The University of London have ordered an ICT 1301 computer which when installed will be used in connection with the University's school examinations work. The task of setting out results for the GCE examinations is considerable, and punched card equipment is already used for this work. One problem that an examining board faces is that examiners are never equally severe nor lenient in their marking, so that it is necessary to 'adjust' examination marks to allow for this by a system of weighting. It is anticipated that the Senate House machine may be used for this sort of application.

Customer control

So many buy on the never-never

'When I see the rate of growth in hire purchase business, especially in the last four years, I am more than ever convinced of the necessity of control,' opined J McQuestion, managing director of the Edinburgh finance company, Scottish Midland Guarantee Trust, at a recent Press conference held to announce the installation of a Ramac computer.

MCQUESTION
A fair share for us

Scottish Midland are the first hire-finance company to invest in a computer, which will be used to keep track of customers' accounts —the machine has the capacity to store information relating to 200,000 accounts—in addition to producing statistical and control information for management.

The primary job—maintaining customers' accounts—involves the initial setting up, posting of instalments paid, the exercise of credit control and closing on completion of payments.

The statistical information produced will include monthly branch profit and loss accounts for each of Scottish Midland's 70 branches and statements of business done daily, weekly and monthly.

The company decided to instal a Ramac machine in June, 1959 —which underlines that the *actual* delivery period for a Ramac system is about 18 months—and state that two factors triggered this decision: expansion in hire purchase business and a shortage of trained staff. (Trained staff were in very short supply and training unqualified staff was a long process, while under a conventional system of book-keeping a rise in the volume of business has to be accompanied by a *pro-rata* increase in staff.)

Scottish Midland are not chary of revealing the cost their installation has entailed. They will pay a monthly rental of £2,800 for their Ramac system (a purchase price would be £134,000) and in addition had to find £6,000 for air conditioning plant and £10,000 for structural alterations so the computer room could support four tons of computing equipment.

McQuestion foresees the hire purchase business increasing for many years—apace with improvements in the standard of living—and comments 'to my mind the only way . . . this company can secure its fair share of the increased market is by means of a computer.'

Data Centre

One more for Newman Street

Due to begin operations by the beginning of this year is an IBM Data Centre, a new computing centre which will be located in Newman Street, London, and which will be equipped with a 7090 computer and a 1401 system. Clients to the centre will have access to IBM's SHARE library of computer programs.

In the USA IBM operate a chain of Data Centres (which are independent of the IBM Corporation and in fact compete with the parent company). Whether IBM intend to establish a similar chain in Britain is still uncertain.

Machine for Bureau

Univac 1 for new company

Last month the formation of a new company—Computer Time Hire Ltd—was reported in these columns. The company, who as their name implies, intend to enter the computer launderette business —a figure of £50 an hour for computer time has already been mentioned—were said to be negotiating for a computer 'expected to cost in the region of £1 million.'

It has now been confirmed that the company are to acquire the Remington Rand Univac 1 machine which has been doing service work at Frankfurt for the German Remington company since 1957. A powerful first generation machine, equipped with magnetic tape units, this Univac 1 was previously used by the Battel Institute (USA) in 1955. The German company introduced a Univac Solid State machine into their Frankfurt centre some time ago, and the Univac 1 machine thus became redundant.

The British Remington company are in no way connected with the introduction of this machine into Britain, but the German and American companies have undertaken to train Computer Time Hire personnel in the use of this machine.

Transacted in London

—and posted in Edinburgh

Since April, 1960, the book-keeping required to keep customers' accounts up to date at the Oxford Street (London) branch of the Bank of Scotland has been carried out 400 miles away at the bank's central accounting unit in Edinburgh. This has been done by transmitting data relating to transactions, through the medium of punched paper tape, by Telex from London to Edinburgh. In Edinburgh, by putting received punched tape records through a tape-to-card converter, account updating can be done on an IBM 421 accounting machine.

Until recently the statements returned to the Oxford Street branch by the accounting unit were entirely in the form of printed output from the accounting machine, sent by post overnight. In order to avoid delays in mail and as a further development of the system an additional machine (a card-to-tape converter) to convert the records at Edinburgh into details on paper has been acquired, so that information can be transmitted *back* to Oxford Street by Telex.

The Oxford Street manager can receive a telex message about accounts the same day, supplemented in due course by the usual details of transactions.

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Pegasus Computer Installation by courtesy of Ferranti Ltd — with Friden Flexowriter (Bulmers Ltd.) in the foreground.

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BOOKS REVIEWED

Automatic Data Processing Systems. By Robert H Gregory and Richard L van Horn. Pp. v + 705. Chatto and Windus Ltd, London (1960). Price 55s.

The more deeply you go into this book, the more impressed you are by the tremendous condensation of information that has been achieved by the authors, and the scope of the facts that they have been able to put over, logically, readably, and intelligently to the non-specialist reader. This is a textbook on automatic data processing —but it is also a positive encyclopedia of reference on computers for people at any level in the data processing hierarchy.

Written by two Americans—graduates of the Massachussetts Institute of Technology—at the request of the Director of Electronic Systems at the United States Army Ordnance Corps; the corps were running a career programme for education in top management studies. This textbook is the result, although it is likely to be of much wider use than its original designers conceived.

Every one of the 19 chapters is summarised; every one has an additional book list at the end for further reading; every one has a questionnaire relating to it (located in a special index at the end) so that the reader can assure himself that he really has got the hang of what has been said. There are seven sections in the book, each completely self-contained, although each follows on in perfect logical sequence. Indeed, each chapter is itself an entity. In this way the executive, if he wishes, can turn straightway to Part Six, which deals with Equipment Acquisition and Utilisation, and then follow this with the two sections on Systems—Processing and Systems Design parts Four and Five. Part Six gives what for me is certainly the best description and the what, how, and why of a feasibility study that I have yet read. For good measure the authors include a history of data processing systems and a 16-page glossary of ADP terminology.

DAVID ROACH PIERSON.

Automatic Language Translation. By A G Oettinger. Pp. xix + 380. Harvard University Press, Cambridge, Mass. (1960). Price $10.00.

This book contains an account of the work on machine translation which has been done at Harvard University. It begins with an account of information processing machines in general and of the Univac I in particular. This is followed by a rather dull chapter on coding and a chapter on automatic coding with particular reference to machine translation. With these preliminaries over, Oettinger sets out to discuss in detail the work which has been done at Harvard on the translation of Russian into English.

Of particular value is the chapter on the classification of Russian words, where, in tabular form, are presented distribution functions for the various parts of speech, an extensive classification of the Russian verbs, and a chapter appendix in which identification rules suitable for machine operation are analysed.

It has often been argued by linguists that the 'cement' words are of more importance in deciding meaning than are the technical nouns, verbs, etc. This fallacy is demolished, once and for all, in the chapter on dictionary compilation, where an example is given of a text in which only the 200 most frequent words are translated and which thereby conveys no information at all. This is followed by a version of the same text in which none of the 750 most common words are rendered, but which is, nevertheless, quite comprehensible.

Because Oettinger only describes the Harvard method, rather than giving a general survey of the whole field of machine translation, the book will inevitably be of less interest to the layman. To the specialist, however, it will be invaluable.

A D BOOTH.

Blackburn Electronics introduce CLARY printers

This unique range of printers includes parallel-entry printers, printing timers, time/data printers, and serial-entry printers.

These proved machines are available to accept decimal or binary-coded decimal information, with or without arithmetic units for addition, subtraction, and totalisation.

Every digital print-out requirement is covered by the CLARY range, from which the following have been taken as typical examples:—

CLARY Standard Data Printers (Series P-5, P-8, and P-11), capable of handling 85% of all data printing. These parallel-entry machines offer 5, 8, and 11 digits input capacity, with a choice of 175 special print wheels, punctuation, and zero suppression logic.

CLARY Form Printer (Model 1941) records data on pre-printed forms.

CLARY Scanning Printer (Model 1961) operates from logical levels of both decimal and BCD information.

CLARY Datalog (Model 1981) embraces all the advantages of the scanning printer (1961) and the form printer (1941).

CLARY Special Printers. Parallel-entry numerical data printers with arithmetic units. Serial-entry printers are adaptations of the CLARY 10-key adding machine.

Other CLARY products include time/data printers, printing timers, printer/perforators, and other combinations.

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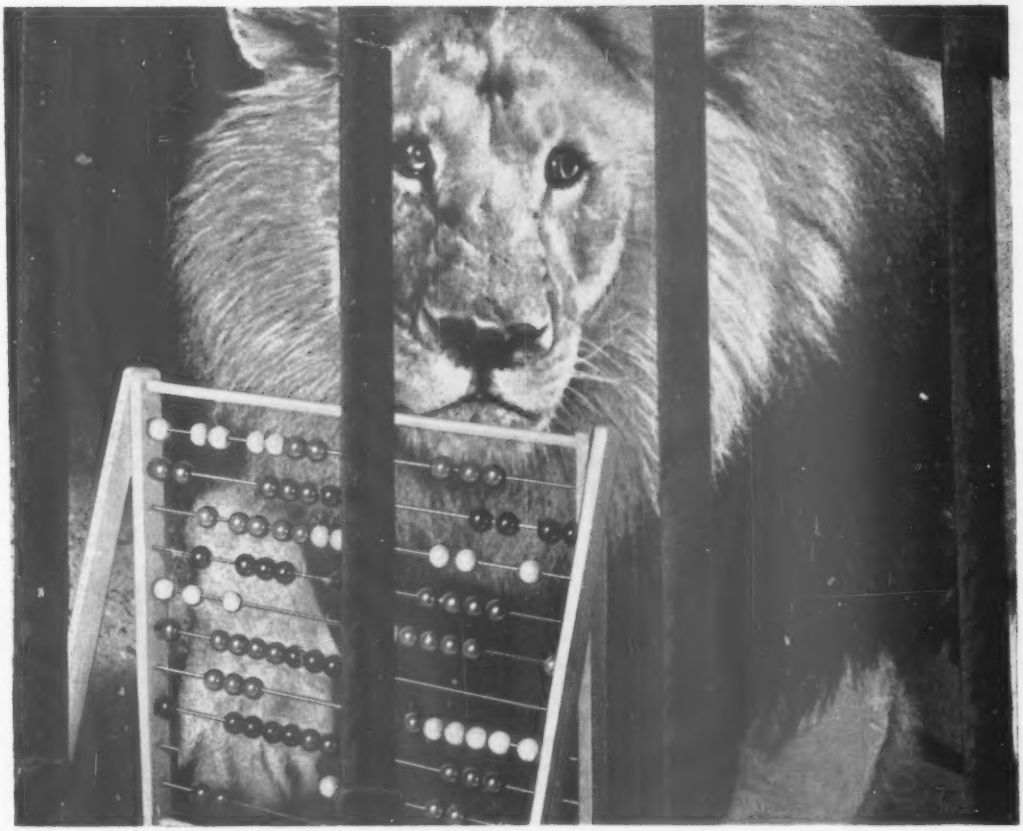

Actually, my cousin at Corby is the clever one

At Corby, Stewarts and Lloyds, one of the largest Steel Tubemakers in the world, use their LEO Automatic Office for everything from payroll for over 8,000 steel workers, whose pay is governed by complex agreements, to abstruse engineering calculations.

Steel is made at Corby out of the iron ore dug in the area. LEO works out how much ore should be dug from each of the pits to supply each of the furnaces with the constituents it requires in their correct proportions.

And at the other end of the process, LEO deals with the invoicing and sales analysis of the tubes and fittings sold from each of the depots all over the country.

A MONTH'S WORK IN 8 MINUTES Among more than 20 jobs handled by LEO at Corby are pipework stress calculations which would keep a fully qualified man occupied for a month. They take LEO eight minutes, checking itself as it goes.

Stewarts and Lloyds associated companies in Australia and South Africa find it quicker and cheaper to air mail their stress problems to Corby than to work through them on the spot.

EXPERIENCED LEO has the added advantage of experience. It is already demonstrating its ability to carry through commercial work against the clock in several industries. Consequently, LEO Consultancy Service can give authoritative advice and help. After a computer is installed they can plan and supervise a smooth transfer of work, and help to select and train staff.

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AMERICAN REPORT

from John Diebold and Associates, New York

Computer Communications —a breakthrough for the sixties?

New developments give a face lift to the old problem of data transmission

THERE has been a recent revival of interest in data transmission in the United States. From the start there has been interest and activity in the use of communications equipment in conjunction with data processing. However, this activity has been limited, in the main, to the larger companies, because of the prohibitive cost of private line facilities. Two developments have spurred this renewal of interest. First, the development by several manufacturers of lines of input-output terminal gear ; and secondly, the availability of equipment that can connect this input-output terminal gear to the dial telephone system. This report reviews the history and current status of computer-communications and will comment on the impact of these developments on the art of systems design.

There are three modes of data transmission which are available for use at present in the United States:

1 Company owned land-line or microwave facilities ;
2 Leased telegraph and voice frequency-type circuits ;
3 Message circuits, *ie*. the telephone network which interconnects all the telephones in the nation.

The uses of microwave systems was discussed recently in this journal*.

Leased telegraph and voice frequency-type circuits are provided by two companies, American Telephone and Telegraph Co through its subsidiary the Bell System, a nation-wide telephone company, and Western Union, the nation-wide telegraph company.

* AUTOMATIC DATA PROCESSING, August, 1960, ' Communicating Data by Microwaves '

Message circuits are provided by the Bell System and a number of independent telephone companies.

Pioneers in Computer-communications

The earliest commercial users of data communications employed leased circuits. In most cases these circuits were in use prior to the installation of a computer system, for the transmission of administrative messages. These are found in large multi-plant or branch companies, and integrating their data processing with a communication system was largely a question of adapting what they already had. This often involved little more than increasing the capacity of the circuits, and in some cases the installation of medium and language converters and different terminal equipment. For these companies, the installation and economic justification of the additional equipment to adapt the present system to the needs of data transmission was relatively simple. However, the majority of companies were not in the enviable position of these large companies; they could not justify the use of a computer-communication system.

One of the largest uses for these early systems was sales order processing. A division of the United States Steel Company installed the following system which illustrates the 'integrated data processing' (IDP) approach. The system involved three stations: a New York sales office, a Trenton mill, and a New Haven controlling mill.

Sales orders are received in the New York office. Prepunched paper tapes containing product descriptions are kept on file. For certain customers, the customer name, shipping instructions, and most frequent ordered items are also kept in the prepunched tapes.

On receipt of an order, the proper prepunched tapes are removed from the file and inserted in an off-line transmitter for preparation of a complete order tape. Variable data are manually inserted in the complete order tape through a keyboard. The complete order tape is then transmitted to the control mill at New Haven. There the decision is made as to whether the order will be processed at New Haven or Trenton.

Assuming that the order is to be filled at Trenton, the order tape is then retransmitted from New Haven to Trenton, and the order is filed at New Haven pending receipt of an advice note to say shipment has been effected. At Trenton, the order is received simultaneously on perforated tape and on a teleprinter which makes a multilith master capable of reproducing all the mill copies necessary; and, on a printer-perforator in the shipping department which punches the information necessary to prepare shipping labels or tape.

The complete order tape and one hard copy are sent to the invoicing department where they are filed until the order is shipped. After shipment, the order tape is inserted in an off-line transmitter and variable data are entered by a keyboard, producing a complete invoice tape. A multilith master to make all necessary invoice copies is produced for this tape on a teleprinter. At the same time, three partial tapes are prepared for sales statistics, accounts receivable and production control. These tapes are converted to the punched cards necessary for each of these operations.

It should be noted that in the operation of this system there is no repetitive typing; all keystrokes are to add information as it develops in the process of filling the order.

Other systems

Other pioneers in data communication include the Aluminum Company of America, which has developed an order entry system. Work on this system began in 1954 and today this system links 67 sales offices over 27,000 miles of cable. Sylvania Electric uses a teletype network to connect scattered plant, office and warehouse facilities with the company's data processing centre in Camillus, New York. The Camillus centre houses a communications switching operation as well as several computers. The computers are used for centralised accounting and payroll as well as order processing.

The petroleum industry is currently using IBM transceivers to transmit accounting and statistical information from marketing and accounting regional offices to corporate headquarters. Some of these companies use their own communication circuits for this transmission, but in the main, leased wires are used. These leased wires are used during the day for administrative communication and expedition of orders with the data being transmitted during the evening hours.

Perhaps the most elaborate computer communication systems now operating using leased wires are in the airlines industry. These systems consist of agent keysets at remote ticket office locations connected on-line with an electronic data processor. A large storage drum is associated with the data processor. This drum contains space reservations on the airline's flights for several months in advance. When a customer requests a seat on a particular flight, the agent enters a flight plate which contains the flight between the points the customer desires into the keyset. If space is available, a light on the keyset indicates this, and the agent may reserve the space. If the space is not available, another light indicates this fact and the agent may then request other space on a different flight. At present, the inventory of space is maintained on the drum as a tally, *ie.* if there are 20 seats on the flight, a count of 20 is stored on the drum. Every time an agent reserves space, this count is reduced. The computer does not

Punched cards containing information on policy applications are duplicated by an IBM transceiver (right) at Hardware-Mutuals' centre: Data-Phone (left) converts audible sounds to electrical pulses to operate transceiver

distinguish between the various seats on a flight, nor is there a record of passenger identification stored with the reservation.

These systems are used at present usually within the immediate vicinity of one or several cities, although a few of these systems interconnect a dozen or more cities. For those locations which are not directly connected to the computer, a system of allocating space to sales offices along the route is used. This allocation of space is based on previous history. Thus, it may not be possible to obtain space in a particular office because its allotment has been completely sold although there may be space available at other offices along the line. To handle conditions like this, space that is unsold will be released at a specified time before flight takeoff for sale at other offices. Notification of this is sent to these offices by means of a private wire teletype system. However, this present system may lose passengers who have previously requested seats and been refused, since they may have opted for other means of transportation. All the major airlines are acutely aware of this problem and are planning for much more elaborate systems to be installed in the next several years.

Developments and what they mean

Within the past several months, a number of announcements of new input-ouput terminal equipment and special computer communications facilities have been made. The size and power of this equipment ranges from small punched card reading units which will rent for 15 dollars a month to giant computer-communications systems which will rent for about 500,000 dollars. The most significant development in terms of broadening the application base will be the smaller equipment. This equipment will also permit companies which could not otherwise afford data processing equipment at several of their remote locations to justify the use of this equipment on a centralised basis with remote input and output facilities.

Some of the most significant announcements include the IBM teleprocessing systems, the RCA DaSpan system and the Digitronic Dial-o-verter. This equipment accepts data on computer media such as punched cards, punched paper tape and magnetic tape, and converts it to a form suitable for transmission on a telephone subset with the trade name 'Data-Phone.' Data-Phones can be used either on a leased wire or on message circuits. An interesting unit of equipment in the IBM teleprocessing line is the IBM 1001. This device will transmit information that has been punched in a card together with variable information entered through a keyboard when used in conjunction with a Data-Phone. It rents for 15 dollars a month—the Data-Phone that is used with it will rent for about 5 dollars a month. When used on message circuits, this will mean that a company with 15 branch offices can transmit data to a computer centre for a cost of about 400 dollars a month, plus the toll charges, and the 400 dollars is about the equivalent cost of an ordinary clerk.

There are about one thousand Data-Phones in operation at the present time. American Telephone and Telegraph Company expects to have at least

10,000 of these subsets installed at the end of 1961 and up to 200,000 of them in operation by the end of 1965.

A typical application of this system is the planned installation of 32 Data-Phones and IBM transceivers in the branch offices of the nationwide Hardware-Mutuals Century Life Insurance Company. This installation will be the largest single use of Data-Phone in current commercial applications. However, it will not retain this unique position for long.

One use for this system will be the processing of new policy applications. It is expected that a policy will be completely underwritten and mailed to the customer within 48 hours after the salesman takes the original application. The Data-Phone will connect the branch offices throughout the United States with the home office in Stevens Point, Wisconsin, where the central computer facility will be located. This facility will consist of four Data-Phones and associated IBM transceiver gear, a small-scale IBM 1401 computer, to be used for conversion of punched cards to magnetic tape and for printed output, and a medium-scale IBM 7070 computer for policy maintenance and analysis.

Another application of this type of equipment is in savings banks. The American Savings and Loan of Detroit is now using the Friden Teledata, punched paper tape readers and the Data-Phone 100 to transmit daily transaction information from its branches to its main office. Burroughs Sensimatic machines located at telecounters are used to record all transaction on eight channel paper tape. The home office can thus summarise its daily activities immediately and thus have an accurate up-to-date knowledge of its cash and interest position.

On the other end of the size and cost scale are the special purpose systems under development for the airlines. Recently IBM and American Airlines announced the signing of a contract for a special purpose computer to be used for on-line reservations which will replace the system now in use. This new system is called the Sabre and is composed of two IBM 7090 computers and associated communications equipment and agent keysets. In this system, every agent in the network will be able to reserve, sell and cancel space from a central inventory. One of the features of the Sabre system is its ability to store in the computer detailed passenger information such as the passenger's name and address, home and office telephone number, a time limit on purchasing tickets and any special requirements the passenger may request. This will permit the airlines to have a tight control on the space for sale on any flight. The detailed passenger records maintained in the computer memory will eliminate the need for written files and duplicate communications equipment to obtain the information in the manual files. Because passenger identification information will be stored with the reservation, any agent in the system will be able to sell the space to the passenger directly from the computer without recourse to any other records.

IBM has been working with American Airlines since 1957 in developing the specifications for this equipment. The system will use nine leased wires with 150 agent sets on each wire. All the electronic equipment will be duplicated. The system will have an annual rental charge of five million dollars. By the end of 1963, it is expected that all cities in the American Airlines system will have agent equipment installed and directly connected to the computer. The first application for the equipment will be in the ticket reservation and selling function.

NEW SCOPE

There are a number of new applications areas which will be opened up by this equipment recently announced. One of these areas will be savings bank deposit accounting. Most savings banks in the United States have their main and branch offices within the limits of a city. At present all saving bank deposits and withdrawals must be made at the office or branch where the depositor maintains his account. Thus, there is no current need to have inter-branch communications concerning the depositor's transactions or account. However, a number of these banks believe that their competitive position could be enhanced if depositors could transact their business at any branch or office.

Several saving banks are currently studying the use of centralised on-line computers for deposit accounting. These banks plan to have a posting at the teller's window which will have direct access to the central computer. Information concerning a transaction will be entered into this machine at the time of transaction. This information will be transmitted to the central computer, where the account will be located and updated and the result will be retransmitted to the teller's window machine. The transaction and updated totals will be automatically entered in the passbook by the window machine. At the end of the banking day, the computer could be used for account and other banking functions.

There are no doubt many applications for computer-communications equipment which have not yet been conceived. We are now at the threshold of a new era in data processing. A spokesman of the conservative American Telephone and Telegraph company stated, 'We foresee the day when there will be some form of Data-Phone device connected with literally millions of the telephones in operation throughout this country! . . . We foresee, in the future, the time when machine conversation will equal the volume of voice communications over the telephone. . . . The day is not too far away when a salesman, returning home from a business trip, may be able to submit his order to the factory via Data-Phone.'

Exclusively to Design Lenses

BACK in 1957 when Taylor, Taylor & Hobson Ltd, the Leicester lens manufacturers, installed a National-Elliott 402 computer, there were still few commercial organisations that had invested in computers exclusively for their own use. Today TT & H are still the only British lens manufacturing company that own a machine, though others in Britain, such as Wray Optical Works, have made use of computer service bureaux.

After nearly four years of use, the computer is now taken for granted and is considered as just one of the tools that TT & H designers use to help in the design of lens, and the company have no doubt that the machine has long proved a satisfactory investment.

TT & H's installation differs in many respects from the complete business data processing systems which have now been installed by other firms. For one thing, all the capabilities of the machine are concentrated on one particular aspect of the company's work—the designing of optical lenses. For another, the computer is run not by computer specialists but by the people who actually make use of the information which it provides. In effect, the lens designers have been given a new and more powerful slide rule.

There was never any question of staff savings; the machine simply enables the designers to do more and better work than was done with their previous equipment. The computer is performing exactly the same kind of calculations as were previously done by less sophisticated methods, but because of its speed of operation it is now economical and practicable to complete many times over the calculations which were done previously, thus resulting in a marked improvement in the company's standard of lens design.

Established some 70 years ago as a family business, TT & H in 1947 became part of the Rank Precision Industries Group. They employ between 600 and 700 people at their main Leicester factory.

The company make a complete range of lens equipment and also a range of optical measuring devices. Their biggest market is in the production of lenses for standard motion picture and studio TV cameras and small lenses for cameras used by amateur movie-makers (a field which is now highly competitive and allows very small margins of profit).

Theirs is the standard 402 machine, which resulted from pioneering computer research carried out under the auspices of the National Research Development Corporation.

Input is by a Ferranti high-speed photo-electric tape reader with a nominal speed of 200 characters per second, and direct output is by means of a Creed tape punch; tapes produced are then transcribed off-line on a Creed teleprinter.

Lens manufacturers Taylor, Taylor and Hobson who four years ago installed a small computer have reaped not merely faster calculation potential but also improved and *economic* designs for lenses

Lens design by computer

Designing lenses is a continuous process. There is no such thing as perfection—all designs represent some kind of compromise. The main question which faces the lens manufacturer is how far towards 'perfection' he can afford to go on purely economic grounds. The cost of producing a lens for a particular purpose, including not only the design, but also the precision manufacturing techniques required to achieve the results specified by the designer, is a decisive factor. The use of a computer helps the design team to go much further than before in improving the performance of a lens designed to be sold at a certain price.

While there have been a few revolutionary advances in lens design since the last war, there has also been a steady stream of improvements in many directions. For example — maximum aperture, resolving power or definition, angle of view and colour correction.

The basic aim in lens design is to make all rays of light from a specific point in the field of view converge at one point in the focal plane. In addition, the performance of the lens must cover the full spectral range and thus give optimum definition irrespective of the colour content of the transmitted light.

The method of working is to start with a tentative design based on past experience and make refinements, by a process of trial-and-error, to achieve the required standard of performance. In doing this the designer has not only to minimise the principal aberrations (such as astigmatism) inherent in any optical system but also to take into account such mechanical considerations as the method of mounting the lens to specific types of camera.

Once a tentative design is chosen it is necessary to find out how the light from the subject is imaged with respect to a chosen image plane. This means that a selected number of rays striking a lens must be traced by mathematical means through the lens to see where they 'hit' the focal plane. Each tracing is a fairly complicated business since the path has to be calculated between each pair of lens surfaces and in a high-quality lens there may be a dozen or more of such surfaces. To gain a reasonable assessment of the whole of the image detail produced by a lens it is thus desirable to trace the path of at least 36 different rays between each adjacent surface and to plot a curve showing how closely they coincide on the focal plane.

The original method of working was for these calculations to be done by girls using five-figure log tables. On average it took five minutes to complete each ray/surface calculation.

For example—to trace the paths of 40 rays through a lens with ten surfaces would involve 400 separate calculations, each taking five minutes—a total of 2,000 minutes or about 33 working hours. This total figure is, however, theoretical since the girls' working pace inevitably slowed down after a time. Nor is any allowance made for mistakes in the calculations arising from mental fatigue or carelessness.

In recent years the five-figure log tables were displaced by electric desk calculators of the tabulating type so that no writing was involved. This speeded up the calculations considerably. When fresh first thing in the morning a girl could handle one ray/surface calculation in about one and three-quarter minutes, although after a period of hours the average was more likely to be one calculation in four minutes. The main advantage of the computer is that it can perform the same ray/surface calculation (but to a higher degree of accuracy)

in two-thirds of a second, and also calculating errors are completely eliminated.

It is impossible to say how many times the basic set of 40 ray traces has to be completed before a satisfactory result is obtained. Much depends on the type of lens—for example, how far its design has departed from previous designs. Altogether, these refinements of basic designs are an extremely time-consuming job when done by manual or semi-manual methods.

The obvious justification for using a computer is that a set of calculations which previously took at least 30 hours can now be disposed of in about four minutes. Much of the work on lens design is repetitive, and the same principles of calculation apply to all types of lens. Therefore once a computer program has been written an enormous volume of work can be done with it. At TT & H there is one master program which handles practically all the calculating work done in the lens design department.

'The computer is not run by specialists but by people who actually make use of the information . . .'

Each component of the lens is broadly defined by three factors.

1—Radius of glass.
2—Refractive index of glass.
3—Separation from previous surfaces.

The laws of refraction are written into the computer program. To produce an answer it is only necessary to enter the required parameters (for example refractive indices) and the curves and thicknesses involved. To design a lens the designers must determine the number of parameters. Providing the limits of change are inserted in the program, the machine itself can automatically change the parameters during the trial - and - error calculating process.

Automatic lens design

Throughout the process of lens design a number of parameters has to be changed simultaneously in order to maintain some form of balance. The human brain can cope with up to five changes at once. A computer is inherently capable of dealing with many more. At TT & H arrangements have been made for six simultaneous changes in the computer program but this is by no means the practical limit. The ultimate aim of this type of work is to get the machine to design a lens from scratch and not simply to check the performance of tentative designs arrived at by human beings. TT & H are now exploring this field in only a small way but they hope to go much further in the years ahead.

When the stage of automatic lens design is reached the computer will be doing something which has never been done before and so it will be impossible to make any comparisons with previous methods.

There is a fundamental difference between the 'machine' and the 'human' methods. A designer working with slide-rule or calculator relies on hunches and thus streamlines the work by eliminating certain possibilities. A computer on the other hand works out everything. At present the computer scores purely on speed. Invariably there is a deadline on the designer's work, so that he has to pose himself the question: 'How far can we go towards perfection in the time at our disposal?'

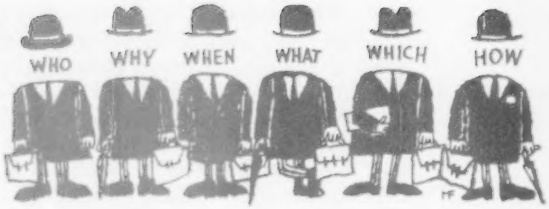
Pushing back the point of no return

The law of diminishing returns applies to lens design. After a certain point has been reached many hours must be spent on making even tiny improvements. Yet the computer's speed enables the design team to go much further than before without the operation becoming uneconomic. In this way it is accelerating progress towards design of lens with wider apertures and wider angles of view.

In the pre-computer period some vital considerations had to be neglected because of the sheer volume of work involved. It was only feasible to calculate ray paths in the plane of the image, *ie.* in two dimensions. 'Skew' rays (*ie.* oblique rays making no intersection with the lens axis) took too long to calculate although such calculations would have revealed important information on lens performance. Now both normal and skew paths can be calculated with the same ease.

Another result of using a computer is that it simplifies the work involved in the design of lenses with non-spherical surfaces — a technique which enables one surface to do the work of several. This, too, is likely to lead to improvements in performance since a reduction in the number of surfaces reduces loss of light transmission and also minimises problems of flair and scatter. This type of work was seldom attempted in the past because of the difficulty of calculating ray paths for non-spherical surfaces.

The need to train 'HONEST SERVING MEN'



One effect of trying to use a universal business machine like the computer is that the need for total re-appraisals — not only by companies in the computer class — has been dramatically underlined, but the men to carry out these 'agonising re-appraisals' — people who will ask who? why? what? which? how? and when? — are in short supply

R Murray Paine

THE installation in Britain in the past few years of tens of computers for commercial applications, and orders for many more to be delivered in the next few years, has meant a great and growing demand (and most attractive recruiting advertisements) for systems analysts. Systems analysts go under a variety of names and tackle a variety of tasks; they are used to determine whether a computer is worthwhile in a company, and to plan its position in the company and its applications. However, companies in the computer class are not the only ones to require the services of systems and procedures experts; the much larger world of smaller firms, who cannot consider the electronic 'juggernauts,' requires skilled personnel for punched card planning or improving manual procedures—questioning all the time the need for any particular method of performing a job. In fact in any place where 'data processing' in its broadest sense—not only 'automatic data processing'—exists, there is a need for people able to improve, change and query procedures and organisations by logical thinking.

The type of people who do this work can be generally classed as 'organisation and methods staff.' The quest since the war for greater oper-

ating efficiency and a more scientific approach to management has led to ' a breeze of change ' and to the rise of organisation and methods departments in firms of all sizes and structures. O and M work is not done for its own sake, of course, and will only continue to be done because it is worthwhile and pays its way. It will pay its way for a long time to come, for every existing O and M man at work, there must be a need for at least four or five more. Yet from where will they come and how are these men to be recruited, trained and given a common body of knowledge and background?

Nine large companies were so worried about the potential supply, and the need to make existing staff more effective, that in 1957 they formed the Organisation and Methods Training Council. The aim was to pool experience, to promote training in objective and analytical studies and to increase effectiveness in organisation and efficiency in methods. It was not that these firms knew little about O and M work and wanted help to start up departments; on the contrary, from their existing O and M departments they knew the value of exchanging ideas and experiences, and thought that in the national interest as well as their own, their knowledge ought to be made available to industry generally. From the names of the firms concerned it can be seen that their views and objects should not be taken lightly—the nine organisations were: The Dunlop Rubber Co Ltd, The English Electric Co Ltd, Imperial Chemical Industries Ltd, The Metal Box Co Ltd, Rolls-Royce Ltd, Shell-Mex and BP Ltd, Stewarts and Lloyds Ltd, Unilever Ltd, The United Steel Co Ltd.

The OMTC was formed for a limited period only, with the idea of:

1—recording and disseminating the best practice of the participating firms.

2—starting, in the main industrial centres, courses of training sponsored by local firms.

In both these main objects the OMTC were fortunate to have Mr G E Milward, formerly of the O and M Department of the Treasury, as director of training to guide the discussions and head any executive that was required.

Very early in its life the council found that no two of their member companies carried out O and M work in precisely the same way. Indeed some of them held, and still hold, opposing views on how to go about O and M, what staff to employ on it, and how long such staff should specialise in O and M. Here then was no attempt to pretend that organisation and methods was a precise science that could be tackled by adherence to a set of rules. The member firms got round this difficulty of working in a field that has no boundary fences, by preparing an analysis and classification of what an O and M department might be asked to do. Each company then took a certain part or parts of the field in which they had considerable experience, and explained their experience to one another, and thereby formed the groundwork for a textbook on the subject and a syllabus for training courses.

PROVING COURSES

To test this subject matter two five-week residential proving courses were held in 1958, and on these courses the originators of the material had to present it to a very critical audience. Course members were divided between those new to the subject of organisation and methods, though not necessarily new to business, and those experienced in the subject. This was done to ensure that the interplay of different and sometimes apparently contradictory experience made the exposition of the various subjects as clear to the novice as to the initiated. The band of critics on these proving courses had the job of approving, improving, changing and illustrating each paper presented to them. Great emphasis was placed on the need for authentic examples of O and M in practice, and known to members of the course. This was in contrast to relying on theoretical or academic illustrations which are often used by colleges or other educational bodies who have not had the necessary participation in the blood and sawdust of O and M work.

These proving courses showed that one form of industry had something to learn from studying the organisation and the methods of other quite different industries. Though precise rules could not be formulated, the council members did agree that the analytical and constructive approach should be the same in each firm. It was appreciated that these would be conditioned by the circumstances.

TEXTBOOK—AND THE SHAPING OF COURSES

The very useful textbook that resulted was finally published in late 1959 under the title ' Organisation and Methods—a service to management,' the draft of which was used on two further national courses earlier in 1959. I was fortunate to attend one of these courses, which included men drawn from a further group of industries and firms who were not on the council, and who had no part in writing the text—in order to make sure that no chapter was peculiar to one company or size of firm.

Although the material generally assumes the existence of a separate O and M section in a company, the ideas apply to companies too small to form a separate section and whose line executives carry the task as part of the everyday duties and responsibilities.

The final arrangement of the courses is well worth studying and differs from the normal organisation of courses on such topics. Nearly all lectures are eliminated and emphasis is placed on participation of the members—there is no opportunity for afternoon naps or glassy stares. There are about 25 people on a course, divided into syndicates of not more than five, and membership of the syndicates changes round each week. It is arranged that one member of each syndicate has some practical experience of the particular subject under consideration; though, of course, the expert on one subject may be the novice of the next subject. This constant moving round of members subjects them to several different methods of approach and prevents the forming of cliques. The ideal system is to read the textbook at leisure before the course starts (though not many students could claim this on arrival) then discuss each subject in turn in syndicates and finally have a round table discussion of all members with a visiting established practitioner. The idea of this visiting expert is to draw from each syndicate a practical illustration of some points mentioned in the chapter, and to fill in any gaps of knowledge that emerge. There is danger here, however, of repetition, or when it is the turn of the last syndicate of a desperate search for any illustration no matter how valid or true.

Each week one of the founder companies produces part of an actual O and M assignment, and this is used to test the understanding of what has been discussed that week, and its applications to a complete job in real life. There are four sessions of about one hour each devoted to the 'problem,' to say nothing of homework in the evening. The first session is used for briefing—the eminent visitor evading leading questions and only answering questions of fact arising from the reading a day or so previously of a short statement of the problem. The second and third sessions take the form of syndicate discussions at which possible solutions (and each problem is chosen to have several) are gradually hammered out. At the final session each syndicate's spokesman presents a solution and really tries to 'sell the idea' to the man who had presented the brief. He in his turn gives the solution the company had adopted. This company solution was often not quietly accepted by the syndicates and the visitor often went away with ideas for improving his own scheme.

From this it can be seen that there is certainly no reason to confuse 'The Organisation and Methods Man' with 'The Organisation Man' of White's book, who conforms to the conventions and dictates of his company and in no way queries existing schemes, nor the decisions of his 'father-like and all-benevolent' company. Naturally a course cannot turn out trained personnel overnight, but members do go back to their firms with the right ideas implanted, ready to gain experience on actual assignments.

As implied earlier the OMTC was not a self-perpetuating body wishing to control all O and M activities, and after the four national courses referred to above it was decided that courses should be held locally whenever possible. During 1959 and 1960 companies other than those on the council, formed regional groups in the South, West, Midlands and North to administer similar training to that of the OMTC and there are now six groups in action. About eight employers are needed to form a local group in order to spread the load of teaching and have sufficient diversity of experience or problems.

DIRECTOR OF THE COUNCIL

G E Milward resigned in 1957 from the Civil Service to found the Organisation and Methods Training Council. Mr Milward was concerned with the first installations of accounting machines in Britain in 1924, then held managerial positions with several companies, specialising in developing, before the war, a management information service. Co-opted into the Air Ministry at the outbreak of the war, he was later transferred, via the Ministry of Aircraft, to the Treasury to set up training in organisation and methods and to develop an information service.

Each group illustrates the council's text with their own practice and by this means it is hoped to train in a practical way a number of men in different parts of the country. The OMTC are ready to provide help and guidance, a copy of a proven syllabus and occasionally visiting speakers. Most of the courses, although formed on a regional basis, are now in fact held at the OMTC training centre in Buckinghamshire. Apart from this training a number of educational bodies are considering making use of the council's textbook and experience.

WHO BENEFITS?

What kind of people will benefit from these preferably residential courses? Very large companies may send staff they have taken on to train for O and M work; smaller companies may send a manager or accountant whom they have detailed to set up an O and M section and train existing staff, other firms may send personnel who have been through several departments and will do O and M work for only a limited period.

Significantly, the OMTC are of the opinion that O and M staff should not be taken straight from university, but that several years of business experience are desirable before undergoing O and M training. An ideal O and M man has been described by Mr J Young of Shell-Mex and BP as possessing the following qualities:

Lucidity—Ability to express himself vocally and in writing.

Originality—Ability to evolve a line of reasoning unhampered by conventional views and customary behaviour.

Sociabllity—Ability to obtain the confidence of people without sacrifice of his own standards of intregrity.

Discrimination—Ability to decide upon the limits of compromise and to differentiate between matters of detail and fundamental principles.

Self Confidence—Ability to face opposition, to accept frustration and to work in isolation.

Restraint—Ability to restrain the impulse to evoke admiration of himself.

THE STRUCTURE OF A FIRM

The textbook serves as a reference manual and a stimulation to action. It has chapters on simplification of office work, details of office machines, how to conduct an assignment, measuring work, the improvement of organisational structure etc. Although it covers a wide field there is little attempt to encroach on the sphere of work-study or time and motion study, though these industrial subjects could be regarded as a sub-set of the whole organisation and methods concept.

The emphasis in most O and M sections, as in the textbook and in the introduction to this article, is on the 'methods' side. But the study of the 'organisation' of a firm can probably reap bigger benefits than any improved method. In many companies, however, the organisation aspect is reserved to the directors or chief executives, not to a body with a brief to be continually looking at the structure of the firm to see if it meets the changing circumstances of the business. Training in organisational problems is especially difficult since wisdom in the subject is conventionally thought to come from long years of experience, or a knack, or being in a position of high command or a knowledge of human relationships.

The textbook however suggests an approach of simplification of structure through common sense, and trying to see the requirements of the firm in the first place away from the personalities involved. There is an excellent chapter on the subject—though I think it may overstress organisational charts—and its use on courses will certainly give greater depth to people who are already aware of some of the problems of industry and commerce.

WHO BOSSES?

One topic of considerable importance covered by the OMTC training courses is that of managing O and M work—how should a section be started, where should it fit in the firm, how is it justified? etc. 'In the nature of things each company' the manual suggests, 'will set up its own department differently. Top management will have their own ideas on how it should be formed and the place it should take; a department head will have his own ideas on how to run it; each company will require different service from it; and these forces will help form a unit different in most respects from that in other companies.' It seems to matter little where in the firm the O and M section should be placed—under the chief accountant, the personnel director, the director of administration, the works manager, etc—what is important is that the sponsor should have the necessary power and drive to firmly establish the practice, and overcome the inevitable early murmurings from his line colleagues of 'interference,' 'lot of nonsense,' 'time wasting.'

An O and M department, however, cannot be an executive department as such; its function is advisory, 'a service to management'—though at times it must be frustrating to see line departments rejecting advice and bumbling through as before. It must sell its ideas to the operating departments in order to make sure the correct solution has been found, and that the solution is not merely a steam-roller tactic of an interested party. Solutions, if enforced may be carried out with a reluctance that render them void and lead to their being thrown out as unworkable or useless. Reputations of 'the razor gang' must obviously be avoided as co-operation will then be non-existent.

JOB MARKET

Who Wants What?

DECEMBER yielded a goodish crop of advertisements for vacancies in the data processing field; until about December 18—when no doubt pre-Christmas turkey began to take its toll of personnel managers—we noted 72 individual vacancies, several of which were inserted more than once.

December witnessed large-scale advertising, for computer staff of all kinds, by two large computer manufacturers, EMI and IBM.

The job pattern of these 72 vacancies broke down into the following schedule of frequency: for programmers 14 applications; for O and M men 12; for consultants 10; for Operational Research men five; for executives nine; and for accountants 16.

Three computer manufacturers (De La Rue Bull, IBM and Leo) required programmers, IBM being specifically concerned with program development. Of the user companies, two were engineering firms —Bristol Aircraft, and C A Parsons; four were major manufacturers—ICI (Dyestuffs Division), Michelin, Crosse and Blackwell, and Colgate-Palmolive; other companies who used a box number device included one in engineering, in a market research organisation, a retail group, and an unspecified 'international group.' Their requirements fell into two broad categories: trainee or junior programmers whom the firms could train themselves, and senior or chief programmers with wide experience (and possibly accounting qualifications). Juniors or trainees were required to have mathematics up to GCE level, to be between the ages 20 to 26, and to want to learn about computers and data processing. Advertisers were reticent about the salaries offered, and only in one case was salary specified for this grade—in this case a ceiling of £750. For the senior or chief programmers the ceiling was up to £1,400, while one chief programmer stood to earn up to £2,000. The senior programmers were expected to have mathematics or physics degrees, or at least two years' programming experience.

With the O and M men required the age range was between 25 to 35. The qualifications required varied; but experience was stressed. Experience in punched card operation was a fairly constant factor; production control experience, an engineering background, and accounting experience were also named. Salaries were only rarely given; an O and M man to carry out a feasibility study was offered £900 to £1,250; systems analysts to undertake feasibility studies were offered up to £1,250, senior systems analysts were offered from £1,250 to £1,500. Of the firms advertising, two were from computer manufacturers (again IBM and De La Rue Bull); three were from heavy industry—British Oxygen, Richard Thomas and Baldwins, and Associated Engineering; two were from electrical engineering concerns — Ericsson's telephones, and GEC; one was from retail manufacturers, Bibby and Co, the animal feedstuffs manufacturers, and one from an unnamed retail group.

The qualifications required of OR men for the posts offered were high, as were the salaries offered. Associated Industrial Consultants offered a low of £1,750 to £2,000 and a ceiling of £2,700 for a man, aged 28 to 38, who was fully experienced in this field. Littlewoods Mail Order Ltd offered a ceiling of £2,000. The DSIR required three years' experience and offered from £1,300 to £1,640; as a government body it could not be expected to compete with the private enterprise giants. BISRA required three to four years' experience but did not specify salary to be offered; nor did ICT who required a leader of Operational Research at an unspecified figure.

Computer and machine companies were once more in the fore-

front in requesting consultants, with IBM, Leo, Bulmers, and NCR all in the running. Consultants were also needed in Australia (under 33 years of age with a degree and chartered accountancy qualifications) and in Canada (aged 27 to 34, bait £3,500). For consultants, a science or maths degree was usually a basic requirement, optional requirements being experience in accountancy, engineering or production control. Both Urwick, Orr, and Urwick Diebold wanted to enlarge their staffs, as did other unnamed management consultants. Salary information was meagre; a 'four-figure salary,' and 'not less than £1,500' were all the clues given.

In the executive category a training officer, an executive for Leo service bureau, an executive for ICT, a data processing manager for BEA, a credit control executive, and a senior assistant for the central mechanisation department of Philips Electrical, were advertised for in a heterogenous batch.

Once again the accountants narrowly topped the list of 'wanted men,' seeming to confirm the view that industry still regards the computer as the accountant's toy. Of course, this classification is a little blurred since accountants may be chosen for other than purely accountancy tasks, for making feasibility studies, etc.

For chief accountants, the basic requirements seem to be a degree (and public school background in one case) and wide experience in industrial accounting and mechanisation. Salaries in this bracket vary from a low of £1,600 to a top salary of £3,000-£3,500 with a car thrown in. £2,500-£3,000 appears to be the average salary mark, and the age range 30 to 45. For trainee or recently qualified accountants the salary offered was as low as £750 for the 18 to 25 age bracket, rising to £900-£1,000 for the more experienced man of the personal assistant category; a cost accountant, aged 27 to 40 was offered £1,500 to £2,000.

Teacher is computer

Programmed teaching gets under way

Last month on the eve of the American Eastern Joint Computer Conference the System Development Corporation of Santa Monica, California, demonstrated an 'automated teaching research machine.' Dr John Coulson, director of SDC's automated teaching project, explained that basic to the system was a Bendix G-15 computer, programmed to sense a student's needs, respond to his errors, and build his knowledge and confidence quickly.

Like us, the Americans have a shortage of qualified teachers that increases annually, and this sort of machine, Dr Coulson believes, could be the forerunner of small individual 'tutor' desk units capable of being centrally controlled by a master computer—'when properly programmed the system could simulate a human tutor and work with as many as 100 students simultaneously—but on an individual basis.'

Instruction by this system is based on the notion of first breaking down a subject into minute sections, presenting the student with brief explanations about one section at a time and then putting to him a question based on the explanations and asking him to indicate which of three or four provided 'answers' is the correct one. At the SDC system demonstration the student selected an answer by pressing a key on an electric typewriter, and the computer acknowledged immediately whether the answer was 'right' or 'wrong' and began to keep a record of performance on each question.

A student who missed a question (*ie*. got it 'wrong') was 'detoured' by the system to a special set of remedial questions, and once his performance with these was satisfactory, he was returned to the 'mainstream' of the course, to be detoured again only when he missed any question.

In this way it is claimed that the machine can be programmed to help both quick and slow learners.

Other teaching machines have been put on the market in the USA though the SDC system is the first to make use of a computer. One such machine—the AutoTutor—was exhibited last year at the Instruments, Electronics and Automation Exhibition. This was developed by the Western Design division of US Industries Inc, and last month Western Design's training system manager visited Britain to assess the market potential for a Mark II AutoTutor designed especially for classroom use and 'specialised teaching and training situations.' He has been reviewing the manufacturing and engineering capabilities of the Burtonwood Engineering Co which was acquired in October, 1959, by US Industries' British subsidiary. Burtonwood will manufacture the Mark II AutoTutor which is about the size of a television set, and which 'teaches' according to the same principles as the SDC system.

Apart from the Solartron group —who developed a machine for training operators for keyboard card punching machines—no British company has yet explored 'teaching machines.'

Management Accounting at Thomas Forman

Nottingham printers Thomas Forman & Sons do most of their business on a bespoke basis, yet manage to draw up annual sales forecasts which are the key to their management accounting system

LAST month the spotlight was briefly turned on the Nottingham printing firm of Thomas Forman and Sons Ltd when it was announced that Mardon, Son and Hall, the printing subsidiary of the Imperial Tobacco Company were to acquire a substantial majority interest in Forman. This move —natural enough as both companies do a fair amount of similar business — does, not, however, mean that Forman will lose their identity: they will continue to operate under their present management.

Forman have long operated a management accounting system which gives firm control over all costs incurred by the firm, and hence over buying, printing processes and sales. Their methods, which enable them to pin down rigorously inefficiencies or discrepancies, must be uncommon in the printing industry which might explain why Forman's new partners are content to let the present management carry on.

By general standards Forman, who were first established in 1848, would not rank as a large firm: they employ 900 people and their factory covers some five acres of floor space off Nottingham's Hucknall Road. Yet within the printing industry—which comprises a multitude of small firms—they count as a large unit (by comparison Mardon, Son and Hall, one of the 'big five,' employ 3,500 people).

Forman's printed products cover a wide range and this is reflected to some extent by the five sales divisions which have been established. A general printing division handles packaging and display items, such as labels, wrappers, boxtops and showcards, a folding box division handles carton and display outers for food, cigarettes, chocolates, etc—for example, Forman design and print packages for many products which are household names—and a business printing division handles the production of all kinds of advertising and business literature — catalogues, booklets, folders, house magazines and annual reports. In addition, Forman operate a stock calendar division, which throughout the year prints calendars and diaries, and offer a stock range (their output of calendars runs well into seven figures), and a division which offers die-stamped stationery and deals with cameo embossed seals produced on foil paper for packaging.

For the services they offer the company employ most of the printing processes available—litho, letterpress photogravure and relief stamp printing—and one or more of these processes will be used for each printing job they contract to do.

Most of Forman's work is bespoke printing: admittedly, the company print calendars the whole year round and sell from stock, but the stock calendar division is responsible for only 20 percent of company sales. The remainder comes through contracts for *ad hoc* jobs.

In spite of this each year Forman's board set sales forecasts for the five sales divisions—in effect, they decide what the sales values will be under each head. When the over-all sales forecasts are made the board draw on, of course, details of sales made after nine months of the year and sales projected to the year's end. This process of deciding on sales for the next year —the board might, for instance, decide to increase sales by five percent over the last year's total —is the key to Forman's management accounting system.

Once sales forecasts have been made the accounts department have then the job of stating what these will cost—in other words, to prepare production budgets.

For the purposes of these budgets Forman carve up the whole undertaking into departments (productive and unproductive) and further into cost centres: groups of identical machines or operatives performing the same function are considered as cost centres. So production budgets are built up in accordance with sales forecasts by printing and ancillary process, by department and by cost centre. These

budgets show what will be the labour requirements and the machine utilisation to fulfil the forecasts and also will give some indication of raw material requirements.

Once Forman have determined over-all labour requirements and machine utilisation to fulfil the production budgets they set standards to absorb all the costs indicated by these budgets. Work study enables them to fix time standards for specific operations (both for machines and men).

The importance of these standards is that as enquiries for bespoke work come in during the year the job estimators can rapidly assess what an order will cost and that the job estimate is in fact the job standard. For example, for any order by assessing the materials required (paper, inks, etc) and by taking the time required on various machines and the man-hours spent supervising these machines (expressed in time standards) and then extending these by the cost rates, a job estimate is quickly arrived at. (This, of course, simplifies a little how the job estimates are built up: office overheads, charges for power and heat, charges on the selling organisation and the profit percentage are also included in the job estimate, but for each of these, save for the profit mark up, there are predetermined standards.)

Forman prepare monthly interim accounts to measure performance against the budgets and variations from the standards set. A main report gives a standard profit and loss summary by process, adjusted by spending, absorption and efficiency variances and non-saleable work (*ie.* spoilt work, experimental work, etc). This summarised information is then exploded in five appendices filling in the details. A sixth appendix is a balance sheet.

These accounts highlight which of the costs incurred are at variance with the budgeted or standard costs, and enable the management to pinpoint what has gone wrong. For example, where raw materials cost more than they should have or where more time was spent on a particular process than ought to have been spent, these would be brought to light. The efficiency variance (where jobs take longer than planned) is not calculated in the usual manner; for each job actual job performance is compared with the job estimate to show up discrepancies, and these, where they occur, can be pinned down to specific cost centres.

Collecting and preparing the information which goes into the accounts, which in turn give Forman's management a comprehensive and easily-understood picture of the operating of the company, requires considerable reporting and analysing work.

To fulfil the needs of their integrated accounting system Forman employ a small ICT punched card installation—they have been users of punched card equipment since 1927, but only comparatively recently has their installation been used for management accounting purposes.

Information from purchase invoices, sales invoices, material issues and daily time sheets is transferred to cards, and as these four sets of documents cover all the expenditure of the company as well as the revenue it earns, the installation can be made to do the brunt of the analysis work required.

Purchase invoices are passed to the punched card department and on to cards are punched the value of the invoice, and a financial account code which indicates whether the purchase was plant or material (*ie.* ink, paper, etc) or revenue expenditure (*ie.* for repairs or for carriage, etc). If the purchase were revenue expenditure a cost centre code number would also be punched. Purchase invoice cards are then tabulated by account code, and by cost centre code.

The office copies of *sales invoices*, before they reach the punched card room, have entered on the back of them, by hand, the established cost elements and the standard profit for the orders that have resulted in these invoices. A punched card is prepared for each established cost and for the established profit. These cards are used for tabulating established sales and their cost by departments (and also by process).

Daily time sheets are passed to the punched card room and the information they contain is transferred to cards. Each of these records relates to an individual man's work for one day, but in the case of machine operators, data relating to the machine are also included. The information punched on to cards relates to the job worked on, the cost centre, the worker's code number, the machine used (if any), the operation performed, the quantity produced and the time taken. Thus from one set of basic time sheet cards Forman can produce these tabulations:

1—An analysis of productive and non-productive time.

2—An analysis of time recorded by operative and cost centre (wage rates convert this to payroll analysis).

3—An analysis of productive time by individual jobs. Standard rates convert this to job costs.

Forman's present installation comprising automatic punches, a verifier, reproducing punch, sorter, interpolator, tabulator and summary card punch could, the company admit, be expanded with benefits to data processing, but the company is currently watching developments in computers as an alternative approach to their requirements, and at least one member of the Forman board has attended computer courses.

Telephone accounting goes modern

SOME 800 million trunk and toll calls are made in Britain each year, and at present tickets for these are prepared by telephone operators—the information on these tickets is required to prepare some 10 million telephone bills annually. It was long realised that punched card equipment might profitably be used to prepare these bills—but, as often happens in these matters, the realisation was not immediately followed by action.

Last August the Post Office announced the first Mechanical Ticket Processing (MTP) unit had begun work in the Telephone Manager's office in Manchester. The Manchester unit currently processes annually information from 55 million tickets for calls made by 350,000 subscribers in 170 exchanges in the Manchester and Liverpool area.

Since the Manchester unit got under way last August, two more units—at Birmingham and Cardiff—have begun processing tickets and last month mechanised telephone accounting was started in Leeds and London.

By the time this article goes to press the Leeds office will have begun processing tickets at the rate of 28 million a year for calls made by 170,000 subscribers connected to about 200 exchanges. The Leeds unit will eventually do the work of the Newcastle-on-Tyne, Middlesbrough, Lincoln, York, Bradford and Sheffield telephone areas.

Clearly MTP units are going to centralise at a small number of regional headquarters the GPO's billing procedures.

Basic to the Post Office's MTP system is the use of the ICT 40-column cards as tickets on which the telephone operators record details of trunk and toll calls—by making marks in pencil in the columns they record a subscriber's number and the charge for one call, and from then on the billing procedure is automatic.

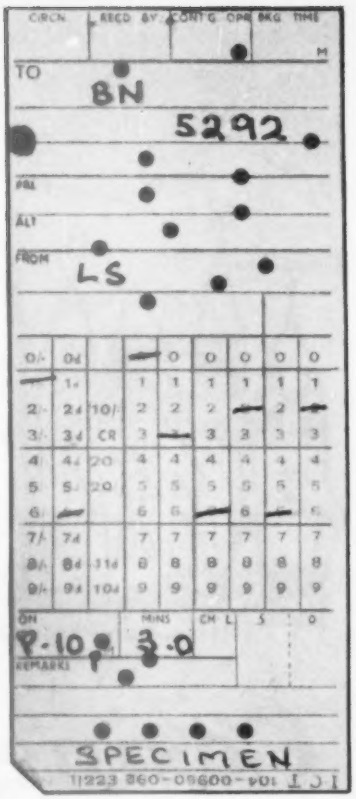
Photo-electric mark scanning punches, developed jointly by ICT and the GPO, convert the marks on the tickets to holes—so that for each trunk and toll call made there is a punched card which records who made the call and the charge for the call.

From this point the cards are stored until required for billing purposes, when they are then sorted mechanically into individual subscribers' telephone numbers.

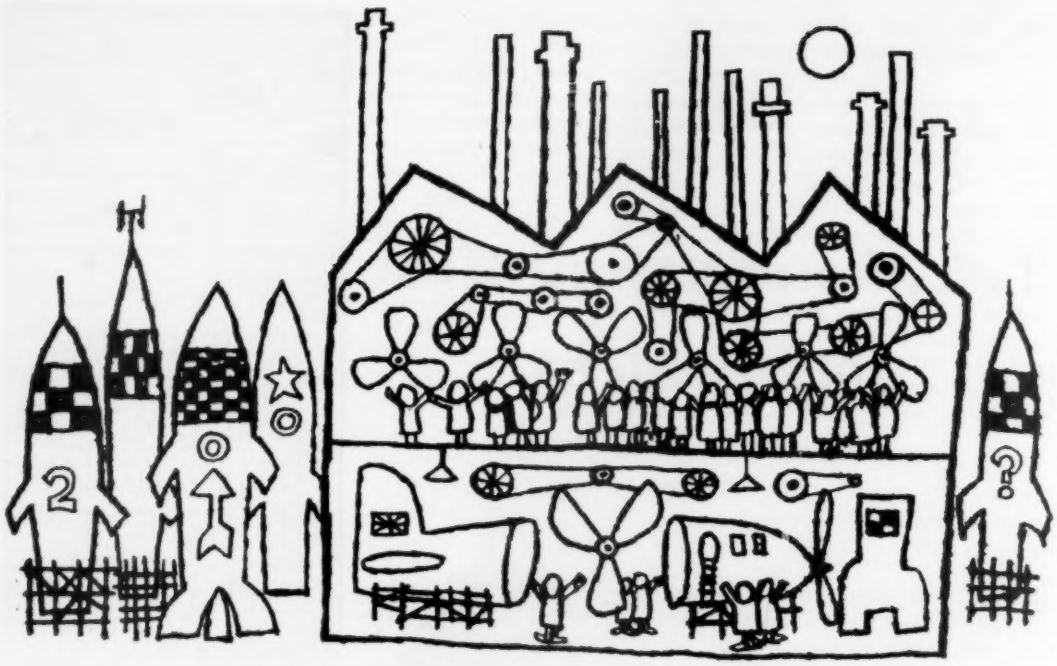
The average telephone subscriber does not, of course, only make toll and trunk calls: tickets (or cards) are also prepared for local calls, and cards for several local calls by a subscriber are normally put through a summariser which (after reading cards at the rate of 200 a minute) punches out a summary card which give the running total.

Summary cards and toll and trunk cards are put through a tabulator, which produces an itemised bill complete with the total owed.

Thus a basic MTP unit would comprise a mark scanning punch, a sorter, a summariser and a tabulator — though obviously each of the Post Office's MTP centres will have several of each sort of machine.

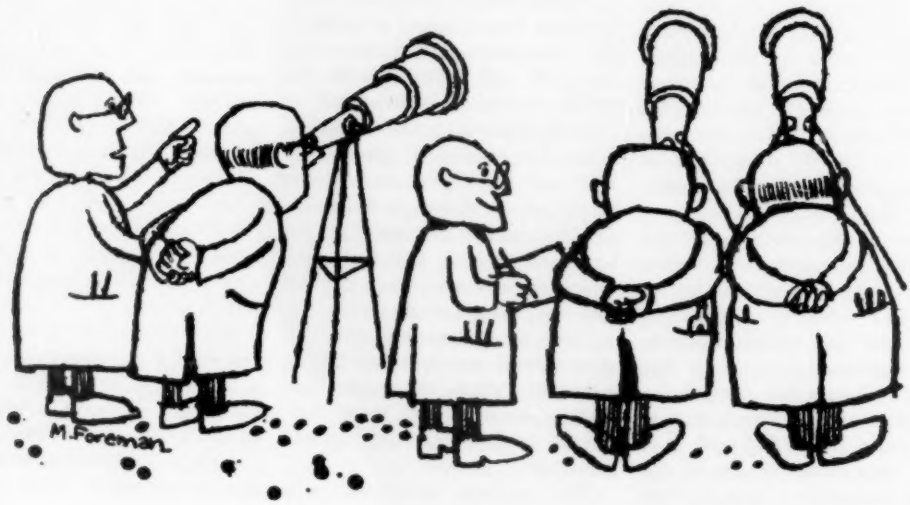


A typical ticket—in this case recording a call which cost 1s 6d from Leeds 26262 to Bridlington 5292.



Casing The Factory

—to see if IDP can be introduced



H Washbrook

The O and M department of de Havilland Propellers' Lostock (Bolton) factory recently completed a study to learn how integrated data processing might be introduced. H Washbrook, who heads the department relates how the study team set about their task and some of the problems encountered in a complex engineering factory

THE company to which this article relates—de Havilland Aircraft Co Ltd—has a northern manufacturing unit of some 4,000 employees. It produces propellers, associated electrical equipment, guided missiles, and mechanical, hydraulic and electronic components.

Late in 1958 an Organisation and Methods department was established to prepare for and instal an integrated data processing system. This initially consisted of an accountant experienced in O and M work, an expert in servo-mechanisms and cybernetics, and several post-graduate apprentices —later augmented by a graduate mathematician, two form designers, and two further apprentices who had become professionally qualified.

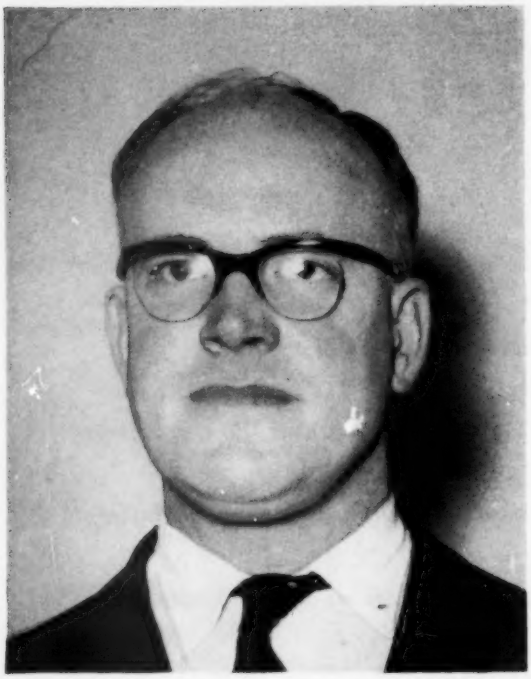
The communications, paperwork processing, and administrative system of the factory, dealing with precision work on job shop principles, was very complex. It was, therefore, especially necessary to establish 'what is' before it was possible to say 'what should be.' This was not easy because there was no comprehensive facility for taking a complete view. A survey system had to be established which would embody inbuilt checks upon the accuracy of the information and which would permit correlation of all the systems extant. As a first step a standard questionnaire form was designed.

As with most large organisations that have grown rapidly, there were individuals whose functional areas or lines of responsibility were insufficiently defined. With guidance from management these functions were re-defined and codified in an organisation structure form. Some by-product benefits of the survey were thus obtained early on.

Each analyst was allocated an area on these organisation charts and interviewed all personnel in it in methodical rotation. As questionnaires were collected for analysing they were cross-checked for validity. If a questionnaire in respect of Mr Smith showed a form from Mr Brown the latter was checked to see that it was included as an output. This, not unexpectedly, revealed discrepancies for re-examination.

A series of symbols was designed, and each analyst converted the questionnaire for a convenient area into a procedure flow chart. It was difficult to decide on the level of detail to be included in the flow charts. Clearly too much detail would eventually baffle rather than help understand procedures.

Related to the level of detail is 'decision flow charting.' At each stage of procedure, flow decisions have to be made according to certain criteria, and these decision factors could themselves



H Washbrook is Organisation and Methods manager for the northern group of the De Havilland Aircraft Company's factories. He founded the O and M department 2½ years ago when he joined the company, transferring from the O and M department of Marks & Spencer

be the subject of separate supporting flow charts.

In a factory of the complexity of de Havilland Aircraft Company's Lostock plant it would need an army of charters or a very long period of time, or both, to carry out decision flow charting. Also, the lapse of time would render much of such charting invalid. The decision flow involved will have to be considered at least as a thought process in designing the basic system. However, this effectively cuts out one stage and the decision flow charts are then limited to the ones that will have to be written into the program of any computer installed.

FIRST AID

It was not the analyst's job to design a good system at this stage, but the flow charts caused certain idiosyncrasies and duplications to obtrude. The analysts were instructed to refer such matters to a sub-section of the O and M department, who carried out full time ' first-aid ' activities.

Each analyst had to see that the inputs and outputs of his flow charts were reciprocated in other flow charts prepared either by himself or other analysts. The checked area flow charts were then adumbrated in block schematic charts covering a logical collection of areas, and, finally, embodied in one master block schematic chart.

A block schematic chart is one in which whole functions of a procedure flow are shown in single outlines arranged sequentially and interconnected in a very broad way to show the outline of a system. Cross-reference is made to the appropriate procedure flow charts for details.

No real attempt has been made to survey the files of information kept, because in some cases they exist in a very complete form as part of the detailed engineering system. In other cases, such as libraries of operations and setting times, these are currently being compiled by the operating departments, at the instigation of the O and M department.

Finally, there have been interviews with senior and middle managers in the manufacturing unit to find out the type and amount of information they require.

In the purchasing and production control fields, an interim scheme to operate on punched card equipment and a PCC electronic computer has been designed and installed. This scheme includes automatic re-scheduling techniques and is to act as a bridge between the present and eventual integrated procedures, and to enable experience to be gained in one or two principles it is hoped to employ in the final scheme.

DIFFICULTIES

Certain problems were encountered. First, there is the general plan of attack on the problem of system design. As production control is obviously the hub of the whole factory, there was a strong pressure to deal at first with this issue only. However, it was felt that any part of a closely interwoven system can best be designed only with reference to other parts. Although the design of a new system is best conceived on the level of the whole factory it is likely that the implementation will proceed in steps, starting with one or more selected areas and subsequently spreading to others.

Secondly, clerks are very unlikely to mention procedures rarely performed (*eg.* once a quarter) and the standard cross-checking mentioned previously is not always a safeguard. It is assumed that each procedure consists of several steps, *eg.* five, each being performed by a different person. If, during the interviewing, the probability of forgetting to mention certain procedures is, say 10 percent, the probability of five clerks forgetting *the same* procedure is 10^5 or practically negligible. If, however, the former probability is very high, say 90 percent, then the total probability of omission at five stages of the procedure is about 60 percent: very real indeed.

Thirdly, the volumes and frequencies of data

processing are often subconsciously exaggerated by the personnel interviewed.

Fourthly, great improvements could be made in the presentation of the information obtained during interviewing. This information must project a mental picture of the administration network involved. As the system in question is of almost unbelievable complexity, on the level of detail required from other considerations, it is difficult to display the information in a form best suited for quick apprehension. We have experimented so far with two ways of drawing procedure flow charts: person-wise and procedure-wise. In the former, all activities performed by particular clerks are grouped together in a drawing (vertical grouping). In the latter, the emphasis is placed on depicting the procedures themselves, each of them being represented by a chain of consecutive, closely adjacent steps (horizontal grouping). With vertical grouping it is easier to show who is doing what, but the resulting network is, as a rule, more complex than in the horizontal grouping.

The fifth difficulty arises in determining essential procedures. In a very small business it is possible for one person to service every order in full. In any large manual system it is impossible for one person to perform all the clerical services connected with a given order. Hence, whether an existing procedure is considered essential or not depends on the proposed degree of integration in the new system which, in turn, depends on the conclusions reached during the survey of existing systems. In this situation a decision on the manner in which to prepare the block schematic is something of a guess.

Sixthly, the establishment of an integrated data processing network is only one of the organisational problems of the factory. There are many difficult administrative problems amenable to treatment by operational research techniques. The effort spent on dealing with these problems not only would be worth while but is a *sine qua non* of the proposed IDP system. A scheme for effective production control and machine loading is probably the outstanding example in this class.

Finally, there is the problem of selection and education of the team. The foundations of the project ought to consist of broad knowledge in the fields of organisation and methods, cybernetics, systems design, information theory, and operations research. On this count it was thought better rather to delay progress than to risk unproductive effort. In the event, this approach has proved to be the quickest. However, as no model upon which to base the team's activities was available, each step has had to be decided in the light of developments up to date and those which could be foreseen. This tended to create an atmosphere of uncertainty about future developments.

The survey, including 'first-aid' measures, the building of the department, and certain interim schemes, was concluded in less than a year. Meanwhile, the task of designing an integrated basic system for computer working is proceeding. The chief problem is the production control arrangements and, in particular, the work loading and detailed machine scheduling facilities.

Although the mathematical representation of the dynamics of such an enormously complex system is probably best coined in statistical terms, the planning of future work must be expressed in a more determined fashion because many servicing activities must be synchronised for the successful completion of any machining or assembly operation. Hence, a definite time-table for the successive targets is required.

WHAT COULD NOT BE DONE

The search for an economically optimum sequence of operating was, however, soon abandoned, as the number of possible combinations was found prohibitive, even for the largest computer. Also, mechanised machine loading covering every detail requires a prohibitive volume of feedback information from the shop floor, due to many unpredictable events. It was thought best to retain a certain amount of human decision by stating only a weekly load of each section of the shop, together with some system of priorities to ensure smooth passage of a given part through a few successive operations in one week. Long range planning will be performed separately. This system is presently being tested in an intermediate electronic computer production control system.

Because of this, and also because production is the reason for the existence of the Lostock unit, the design of the system will be based upon the production control system. Also, whereas such services as accounting and costing can be moulded to the production system, the converse would not be acceptable. So, unlike with many companies, such things as payroll will be left strictly to the last.

LESSONS LEARNT

We have had to satisfy ourselves on many initial points of doubt. It was realised that an alternative approach to charting existing procedures and systems would be to ignore them and design a theoretical system to achieve the end results. We decided on the former because we did not feel confident enough that we could cover 'all the angles' with a theoretical system.

Even if a perfect system could have been devised on paper, it would still have been necessary to know the present systems thoroughly, if only to plan the changeover period. Existing procedures cannot be stopped in phases unless one knows exactly what those procedures are.

A general view of the 315, showing in the background three tape units and one Race unit—National's random access storage device.

National announce a new system

FOR some considerable time it has been an open secret that the National Cash Register Co would market a new computer—designed by the American parent company and to be built by Elliott Brothers of Boreham Wood. Now at last that the cat has been officially and somewhat gingerly let out of the bag we can assess what kind of a beast it is and to whom its purring will appeal.

Described as 'designed exclusively for business work' the National 315 system is based on the American company's operating experience with their large 304 system of which a small number have been installed in the USA.

The 315 is in line with the latest computing systems announced by other manufacturers in that it computes at very high speeds, offers a degree of 'time-sharing,' is completely transistorised and uses ferrite cores for storage, and can be linked to a wide range of peripheral equipment.

As each peripheral unit has its own power supply and can be fitted on site without engineering work, it is possible to expand a 315 system

by adding extra units so that the installation 'grows' with requirements, which is also in line with the latest developments.

The system comprises a central processor, a control console with keyboard and monitor printer, and the following range of (optional) peripheral equipment: paper tape readers, punched card readers, document sorter/readers, paper tape and card punches, fast line printers, magnetic tape memory units, enquiry units, and a revolutionary random-access store.

The 315 has a single-level, high-speed internal memory—a linear-select ferrite core store with a basic cycle time of six microseconds. This main store comes in three types with varying capacities: one holds 6,000 digits, the second 15,000 digits, and the third 30,000. With a machine fitted with the third type of store—the 30,000 digits unit—three further 30,000-digit stores may be added, providing immediate access to a maximum of 120,000 digits.

The internal speeds of the central processor are, as one would expect, considerably higher than those of machines in current commercial use. For example two six-digit numbers can be *added*, *compared* or *recorded* in the store in 48 microseconds; 288 microseconds is the time required to multiply two three-digit numbers. These times include access to both commands and operands in the core memory, and also the modification of addresses.

The 315's order code provides facilities for over 160 different functions. These include built-in comparison and test facilities, and sub-routine linking and editing facilities. The 315 is designed to accept programs written in COBOL and a COBOL translator will be available to first 315 users.

Random access to information

With the 315 National will market their own peripheral equipment (previously National-Elliott machines employed some peripheral equipment produced by other manufacturers) though it is not yet clear whether all these units will be manufactured in Britain.

One peripheral unit of significance is Race—a random access memory that differs completely in principle from other random access memories so far produced. With this equipment National Cash becomes the third computer company to offer systems that overcome the problems that serial recording on magnetic tape impose. The Race system employs Mylar plastic cards on which information is recorded magnetically. The cards are held in removable cartridges—and each cartridge has a capacity of over 5,000,000 alphanumeric characters. A maximum of 16 units can be linked to the 315 computer so that over 84,000,000 characters of information—immediately retrievable—can be recorded in this way. Also, the cartridges are interchangeable, like magnetic tape reels, so that the total filing capacity of a 315-Race system would be unlimited.

With the development of their Race system, National become the third company to offer a random access storage device—IBM's Ramac equipment has been available for some time, and more recently Remington Rand in the USA announced their Randex system

A random access memory system can be supplemented by using high-speed magnetic tape units for laying off information in ordered sequence.

With the 315 comes a choice of two types of magnetic tape units—one providing a transfer rate of 30,000 characters per second, and the other 67,000. The maximum number of tape units that can be coupled to the central processor is eight.

Input to the 315 can be via a paper tape reader which picks up 1,000 characters a second or two card punches: one operates at 400 cards a minute and the other at the very fast speed of 2,000 cards a minute.

Output from the system can be in the form of paper tape, cards or hand copy: the tape punch hits out 110 characters a second, the card punch runs through 250 cards a minute, and the line printer (which was reviewed in AUTOMATIC DATA PROCESSING, July, 1960) prints out 850 lines a minute.

A combination of line printers and card punches —up to a maximum of eight units—can be linked to the central processor.

Up to 16 enquiry units can also be linked to the central processor. Each unit provides alphanumeric input and output via a buffer, and can be used for exception reporting.

The price of the 315 system will vary (according to peripheral equipment requirements) from a basic £80,000 to over £300,000. No price has yet been fixed for the Race memory units but these are likely to cost no more than magnetic tape units —*ie*. £15,000 to £20,000 each.

SURVEY — PART IV

'SELF-CONTAINED' SYSTEMS

IN addition to data processing systems based on computers there are a number of equipments, semi-automatic in operation—usually electro-mechanical devices—which are able to originate and carry through a complete business function: stores control, invoicing and ledger posting documentation, etc, can be done from start to finish on this kind of equipment. These systems are usually a half-way stage between the hand-operated mechanised system based on the accounting machine or electrical typewriter, and the completely automatic system based on the computer. Of course, punched card installations represent quite often such a half-way stage, and are 'self-contained' systems in the sense that they produce 'end-results.' There are, however, other self-contained systems, apart from punched card complexes, and these are reviewed below. Generally, the definition of a self-contained system is one that:

1—Receives and acts upon an original record (a goods received or stores issue note, a customer order, or docket from a previous operation within the organisation);

2—Performs a calculation, according to the facilities built into the machine, utilising a memory storage capacity, or some kind of programming device;

3—Prints out a record or records of the transaction;

4—Retains the information in one form or another for further processing, either within the equipment, or in the form of paper tape or cards for subsequent processing (possibly on a computer or other data handling medium).

It is possible to break down the types of equipment to be reviewed here into four categories:

(i) Calculating machines with memory storage. In this group come the Electronic Storekeeper, for holding, updating, and printing out, as required, totals of items held in a store: and the Addo-Matic, used for collecting information from remote points, storing it, and printing out according to a programmed schedule.

(ii) Combined adding-multiplying machines for producing all documents relating to a transaction in a single operation. Into this class would come the Compu-tronic. In this class also would be the Post-tronic, an automatic account posting machine, though it is not directly comparable with the Compu-tronic.

(iii) A programmed typing system utilising paper tape and card input and/or output, as well as utilising the typewriter keyboard for input data and as an output printer. This equipment comprises the Flexowriter range.

(iv) A combined calculating and programmed typing equipment capable of producing complete documents from paper tape or card input, or to produce as output tape and/or cards. This equipment would comprise the Friden Computyper.

The Electronic Storekeeper

Maker: Electronic Machine Co Ltd

The Storekeeper is an electronic calculating and data storage system, designed to up-date stores records, and to maintain an adjusted 'catalogue'

of all items held in stock for instant read-out. It is also able to store a 'minimum level' figure for every item, which would be compared with the item total every time an adjustment is made to stock.

The basic machine consists of a magnetic storage drum (or drums) an arithmetic unit, an electronic control unit, and appropriate power units. The whole equipment is housed in an integrated cabinet about the size of an office desk.

The data input can be either through a push button keyboard or through a modified electric typewriter. It is also possible to connect the system with a punched tape reader or punched card reader, if required. The prototype keyboard has three digits for catalogue reference number, and four digits for quantity of goods received or despatched, plus five control buttons. Naturally this keyboard would vary with customer requirements, and could indeed accommodate 14 buttons for all the various permutations of a three-balance system.

The data output from the drum (or drums) is either by means of the electric typewriter and/or visually through neon display tubes situated above the keyboard. There are two sets of tubes on the prototype model, for the original stock total (or revised stock total, if required) and for the amount (with plus or minus sign) which is to be added or subtracted. The number of display tubes could be modified to suit customer requirements and if a three balance system is used a display panel could be assigned for physical, actual, and reserve stocks, if required. Data output could also be via a tape punch or card punch if required.

The magnetic drum is designed for reliability and capacity rather than speed, and has a diameter of 16 inches and a revolving speed of one second per revolution.

It is able to store 10,000 seven-digit records in the 10,000 address positions around the drum. This is a useful figure since it allows for four digits for the stock record, and three digits for the minimum stock figure. Nevertheless, the arrangement of the drum is modifiable, depending on customer requirements. There are 144 recording tracks, 140 for data, and four for control purposes. Up to four drums can be linked to the system.

The arithmetic unit is directly designed to customer requirements, and calculates in decimal. The calculating time for an updating transaction is about two milliseconds. The electronic control initiates the read-in storage, transmission, calculations, and print-out in the correct sequence.

Operating the Storekeeper (only a prototype model has so far been built), would be as follows: The operator would key into the machine the catalogue reference of the item and the quantity from the goods received or stores issue docket, and this latter figure would appear on the neon tube panel. The operator would check the figures and press the plus or minus key causing the quantity to be sent into the arithmetic unit. The key 'enter' would then be depressed which would cause the appropriate stock total to be read from the drum, featured on the display panel, and transmitted to the arithmetic unit. This operation would take about one second. The stock figure would be updated in the arithmetic unit and then read back into the drum. At the same time the typewriter would print out the old stock total and amount just fed in. If the 'minimum stock' feature is incorporated, the revised total would be automatically compared with the minimum stock figure, and if stock has fallen below his figure, the print-out will be in red. The time taken for the complete read-in, print-out operation would be about two seconds.

Reference numbers for all items and the stock totals can be printed out automatically as a continuous list. Another optional feature is automatic stocktaking, by which the machine can be automatically set to print out a complete itemised inventory without operator intervention. The only disadvantage is the bulk of the record produced, which, however, can be overcome by programming the machine to print out only the stock levels below the specified minimum. This print-out can be done over a week-end, for example, and a control switch would automatically switch off the equipment on the conclusion of the exercise.

SPECIFICATION

Cost: from £4,750.
Drum capacity: 10,000—7 digit items.
Recording tracks: 144 (140 for data, 4 for control).
Address positions: 10,000.
Total updating time: two seconds.
Delivery time: seven to eight months.

The Addo-Matic

Agent: Bulmers (Calculators) Ltd

The Addo-Matic is a calculating and storage system which permits stored information to be updated from a number of sources, and which prints out documents as required. The master unit consists of the Wegematic memory drum connected with a series 700 Addo-X adding listing machine. To this basic unit can be linked other adding machines at out-stations, which would be connected directly with the drum, for reading in

and extracting data from the system. Up to 20 out-stations may be connected to one drum unit. The drum unit can be expanded in capacity by linking other drums to the master machine—up to 10 drums can be incorporated.

Input would normally be by keyboard operation via the branch adding machines, or through the keyboard on the master machine, but it would also be possible to input with punched cards and punched tape. A complete read-out of the contents of the drum would be printed out on the central machine, though the system could be linked to a card or paper tape punches.

Likely applications for this system would be for stock recording procedures; for providing a diary of seat bookings for travel agencies; for updating daily prices of shares, and many other applications where information is to be fed in from a number of sources.

SPECIFICATION

Cost: from £8,500 (for basic unit of one 700 series Addo-X and one Wegematic memory drum).
Drum capacity: 700,000 decimal digits of information. (10,000 words of seven decimal digits and plus or minus sign, or other combination as required).
Time required to search, read and print: one second for a seven-digit unit.
When automatic input/output is used:—
Input speed: 10 characters per second from tape or punched card input.
Output speed: 25 characters per second for tape or card punching.

The Compu-Tronic

Maker: National Cash Register Co Ltd

This is a self-contained unit accounting machine which handles sales accounting, payroll etc—calculating, accumulating and printing hard copy documents in a single operation.

It can be coupled to a paper tape or card punch to provide computer input for subsequent analytical processing.

The Compu-Tronic consists basically of a National Class 31 direct entry accounting machine with a built-in electric typewriter, interchangeable program bars, fluid-drive carriage and a variety of automatic features. Linked to this is an electronic multiplying unit which operates automatically.

The operator enters the factors on the keyboard and the electronic unit takes over. Sterling amounts are converted to pence, multiplied, checked and reconverted. All documents relating to payroll, for example (earnings and tax record card, payroll and pay device), can be produced in one operation. This is also true of sales accounting (invoices, ledgers and statements) and the many other applications to which the machine can be directed.

Up to 15 pre-determined factors, each taking the form of a small interchangeable printed circuit, can be placed in the machine. The program bar controlling the machine's functions can select any one of these automatically as required for the calculation; in addition, nine can be key-selected by the operator. The factors can be used for percentage calculations involving discounts, interests, dividends, etc. They can also be used as conversion factors (*eg.* hours to minutes, pounds to tons). The electronic unit can also handle decimal and decimal pence multiplications.

Applications for the Compu-Tronic include payroll, stores control, dividend warrants, sales accounting, public utility billing, building societies' accounts, stockbrokers' accounts, banking and finance house accounts.

The cost of this equipment is about £7,000 and delivery time is approximately 18 months.

The Automated Post-Tronic

National Cash Register Co Ltd

The fully automated Post-Tronic consists of three intercoupled units: a Post-Tronic ledger and statement posting machine, and automatic document feeder and a paper tape reader.

The basic Post-Tronic, available separately as a semi-automatic account posting machine, is largely mechanical in design. It has a keyboard for entering data (although in the fully automated model this operation is taken over by the paper tape unit), mechanical registers for accumulating totals, and a printing mechanism which simultaneously produces three documents.

The Post-Tronic uses a special type of account form, usually combining ledger card and statement. Information is reproduced on the front of these in ordinary print; on the back there are a series of magnetic ink stripes recording the number and outstanding balance of the account and also form alignment instructions. The Post-Tronic reads this magnetically-encoded information as each form is inserted and automatically updates the balance and printing instructions at the end of the posting operation.

In the semi-automatic model the account number is automatically checked against the operator's keyboard entry to ensure that the correct form has been selected. In the fully automated model this feature is used to select the cards which have to be updated with information

previously recorded on paper tape. Three documents—ledger, statement and summary sheet—receive identical impressions in original print. The printing mechanism—extending almost to the full width of the Post-Tronic—consists of a series of individual print wheels, one for each column on the three documents.

The input hopper of the automatic ledger feeder holds up to 1,000 large account cards. Updated cards are stacked in a compartment in the base of the ledger feeder. If required, the machine can be made to outsort certain designated accounts (*eg.* those with credit balances) into a second compartment.

The tape reader handles five-channel paper tape; each digit is represented by a four-bit code and parity check bits are punched into the fifth channel. The tape is used to initiate the search for a particular form and also to enter details of new transactions.

By means of a rotary switch the supervisor can select any of six different programs for the system. These are usually as follows: —

1—Install—for setting up new account forms by means of keyboard entries.

2—Transfer—for automatically producing a new set of account forms when the statements are due to be sent out.

3—Posting 1—for normal, fully automatic posting of debit and credit charges.

4—Posting 2—for switching the Post-Tronic to manual posting.

5—Trial balance—the machine automatically reads the outstanding balance recorded on each card fed to it and compiles credit and debit balance totals.

6—Adding—enabling the machine to be used manually as a multi-register add-listing machine.

SPECIFICATION

Searching time: 1.33 seconds per card.
Search and posting one item: 6.2 seconds.
Search and posting two items: 7.4 seconds.
With a normal level of account activities (say two entries to every other account) the equipment is capable of processing some 850 accounts per hour.

An automated Post-Tronic system costs about £12,500 and delivery is about 18 months.

The Flexowriter SPD

Agent: Bulmers (Calculators) Ltd

The Flexowriter is an automatic typewriter which can read, reproduce and punch punched paper tape and edge-punched or tabulating cards. This reading/punching facility means that it can be used to prepare its own programmed tape for subsequent processing, at the same time as the operator prepares continuous sprocket punched forms on the typewriter keyboard; and further, it can be used for automatic typing as an output printer, using programmed tape or cards, and can simultaneously produce one or two selective by-product tapes for further processing or for feeding to tape-to-card converters.

The versatility of this system is therefore considerable, and a whole sequence of operations can be envisaged as forming part of an integrated Flexowriter system. One example might be the control of customer orders, from the moment they are received and priced, until the delivery note invoice and statement are severally despatched. As soon as the orders were received and priced, the operator would manually type the production order and prepare a paper tape simultaneously. Of course, if the customer regularly ordered and the conditions and indeed the quantities standard, an edge-punched card with these constant factors could be inserted in the card reader, and the details typed automatically. It is possible to have three types of input operating simultaneously: an edge-punched card for the constant factors relating to a customer, a punched tape for the program (which items are to appear, which to be omitted, what to appear on the by-product tape, if program tape to be copied and data punched tape). From this initial typing, therefore, the hard copy record (and necessary copies) is produced; likewise a complete tape can be punched for subsequent action—automatic typing of the invoice, etc—and a selective tape can also be produced. Instead of a tape, edge punched cards can be prepared. The punched tape can later be fed to a tape-to-card converter machine to produce tabulating punched cards for computer input. Subsequent typing from the by-product or cards can be completely automatic.

Possible applications for Flexowriter systems include purchasing (with subsequent statistical analysis), preparing production and works orders —including ordering of materials—invoicing with subsequent statement preparation and analysis, posting, etc.

A fully integrated Flexowriter system could have a tape reader operating at 572 characters per minute, and a card reader—taking either edge-punched or ordinary tabulating cards—operating at the same speed. It could have as output a card punch or tape punch—operating at up to 1,000 (card) or 1,200 (tape) characters per minute. The SPD stands for Systems Programatic Double-case. This is the model most widely used in this country; it is also possible to have a single case machine—as used mostly in the US—also there

are variants in the keyboard (whether three or four bank, etc) but these do not affect the basic working of the machine.

SPECIFICATION

Cost: from £1,747 for the basic unit.
Cost for the ancillary equipment:—
For auxiliary punch—£486.
For Selectadata—up to £969.
Input
By tape or card reading.
Input speeds: 572 characters per minute on five- or eight-channel tape or on edge punched cards.
Output
Automatic typing: 100 words per minute.
Card code punching: up to 1,000 characters per minute.
Tape code punching: up to 1,200 characters per minute.

The Flexowriter SPD linked to SRD/P

Agent: Bulmers (Calculators) Ltd

This is a variation of the basic SPD, utilising a slave receiver. In this way the slave and the master would be controlled by the same program tape to print out two entirely separate documents (or sets of document) simultaneously; in the same way the program may be so coded that the two machines punch out selective by-product tapes simultaneously.

A typical application for this flexowriter system might be in the preparation of production orders. The master machine would type out the complete order; the slave would type out all the subsidiary instructions, picking tickets, route tickets, packing slips. In the same way the system could be used for printing of orders/bills of lading, insurance policies/policy records, and many similar operations where dual preparation of selective data was needed. The cost of the SRD/P (double case) is £1,592, plus an additional £27 for extra parity checking.

The Flexowriter SPD plus Selectadata STR-AD-SD Synchro Duplex Model

Agent: Bulmers (Calculators) Ltd

The SPD using the Selectadata is given additional program storage facilities, and it is easier to treat it as a separate system, though in fact the Selectadata is an optional ancillary equipment attached to any eight-channel Flexowriter or Computyper. This method allows input media (conventional or edged punched cards or punched tape) to be selectively programmed for several different applications, or variations of the same application. This means that only the 'raw data' need be stored on the tape or cards, while the Selectadata provides the program, allowing all or any part of the data to be used and/or repeated at any time, without operator intervention.

In practice the Selectadata would operate as follows. First, the customer and constant data would be read; next the equipment would read cards selectively, the correct programming for each card being selected by the automatic address selector feature. The manual data selector would cause 'our order number' and order data to be automatically inserted; and the correct price for that class of customer is read out of the item card according to the stored customer category from the three alternatives (Retail, wholesale discount or manufacturer discount). The specifications of the SPD plus Selectadata would be:—
SPD £1,747 plus self-programming Selectadata from £562 to £969 depending on number of internal features.
Search speed: 22 codes per second.
Number of addresses per tape: 127.
Reading time: 572 codes per minute (100 five-letter words).

The Friden Computyper CTS-816-D

Agent: Bulmers (Calculators) Ltd

One of the major disadvantages of the Flexowriter system is its lack of any kind of calculating mechanism to render the equipment wholly self-contained. The Computyper goes some way to redeeming this need and is very widely used in the US and in Europe for invoicing, payroll, insurance calculations, etc. The Computyper is a decimal calculating unit integrated with a Flexowriter keyboard and reading punching facilities.

In a typical operation in this country, where the machine is used for industrial calculations, the input of the fixed factor would be by punched cards the variable factor — the quantity, etc, would be manually entered, and then the Computyper would take over, calculating printing out extentions, percentages of increases or decreases, sub-totals and grand totals. In this way the calculation of quantity by weight in decimal pounds or metric weight can be achieved simply, with minimum operator intervention.

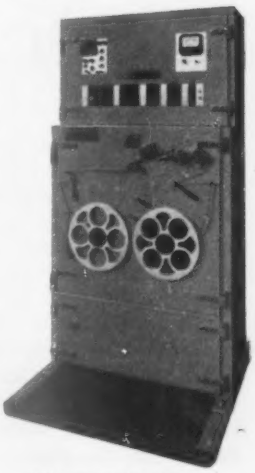
SPECIFICATION

Cost: £5,163.
Speed of input: 572 cards per minute.
Speed of output: 100 words per minute.
By-product tape punched at 1,000 codes/minute.

AS PERFECT AS HUMAN SKILL CAN ACHIEVE

The symmetry and perfection of an ancient Greek vase is a criterion for human skill and craftsmanship. Today automation and computer systems call for even more exacting standards in the manufacture of Data Recording Tape. Even tape produced under the most immaculate conditions, such as those existing within the MSS organisation, must still be realistically tested and *proved* to be of sufficient quality.

MSS are unique in possessing a Drop Out Rate Analyser of their own design and patent, which can test tape across eight tracks simultaneously, at 100 inches per second, in a way which accurately predicts its performance under extreme conditions. By means of this exclusive system MSS Data Tape may be used with complete confidence. In fact MSS Data Tape alone is realistically tested, and is as nearly perfect as human skill can contrive.



MSS Drop Out Rate Analyser.

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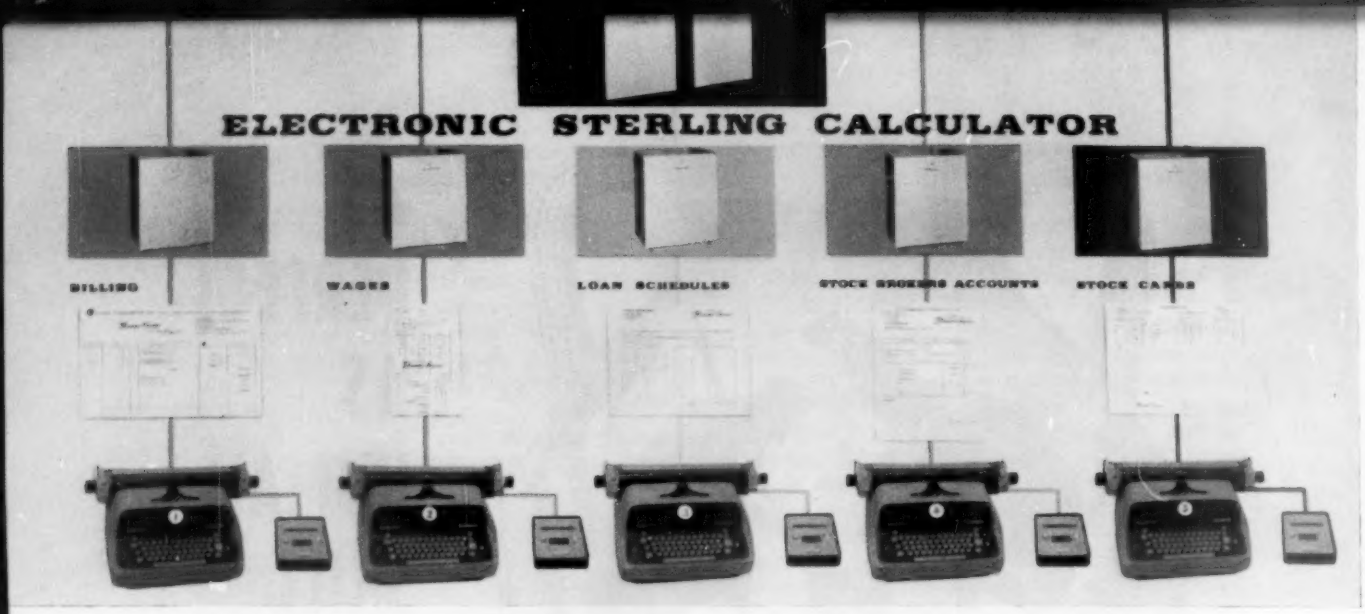
M.S.S. Recording Company Limited, Poyle Trading Estate, Colnbrook, Bucks. Tel. Colnbrook 2431.



WHAT'S NEW in systems, services and equipment

Time-sharing Calculator

THE Banda-tronic, designed by Block and Anderson, and developed and manufactured by Pye of Cambridge, is a bold attempt to produce integrated internal accounting without resorting to a computer. By means of this equipment all the major departments of a firm, purchasing, invoicing, wages, etc, may produce their own records and do their own calculations quite independently, albeit using the same central calculating unit.

The central unit of the Banda-tronic consists of two cabinets about the size of a filing cabinet; in one of these is housed the arithmetic unit, and in the other, the electronic programs and channel selector. The arithmetic unit is extremely fast by non-computer standards, being able to carry out a 10-digit multiplication in less than half a second. It also utilises a totally new technique of adding, subtracting, multiplying and dividing in sterling.

To the central unit can be connected up to five 'outstations' for data input and output. These units, which can be located remotely from the central unit in the appropriate department requiring the information, would consist of two units, the input-output medium—a solenoid operated electric typewriter—and the buffer and program store. At present these two units are separate—as shown in the illustration—but it is intended that in the production models they will be merged, making a console-like 'desk' on which the typewriter will be mounted. The buffer store contains two sterling stores for addition and subtraction, and three sterling stores for multiplication; it is able to accommodate up to five programs if required. The 'outstation' would be wholly independent of any other outstation, and would proceed with its own documentation and calculation, regardless of the others who might be simultaneously using the calculator, for a totally different operation. The infeed of data from the various units would be the responsibility of the program selector.

A typical operation for invoicing, for example, might well be as follows:

The operator takes the preprinted invoice, and inserts it in the typewriter, typing out customer details—if not previously entered with an addressograph plate. She would then clear the machine by pressing the 'clear' button on the special keyboard built into the foot of the machine; next she would type in the quantity (the multiplier) the description of the goods, and the price (the multiplicand) which is simultaneously typed on the sheet and stored in the access store of the buffer unit. On pressing the control button the contents of the access store—together with any stored totals and sub-totals—would be taken in to the arithmetic unit at the discretion of the channel selector; the calculation would be performed, and the product and

updated total(s) would be read back into the buffer store. This action activates the carriage return mechanism of the typewriter, causing the product to be printed out on the sheet. The amended total(s) would be held in the buffer store ready to be read out and printed on the sheet at any time.

Control keys also allow adding, subtracting and division to be carried out, as well as percentages and discounts, the latter being printed out automatically in red. Another switch programs the calculations so that all amounts are calculated to the nearest penny. All these control buttons are located on a special panel built into the typewriter, though on the prototype shown in the illustration they form a separate keyboard.

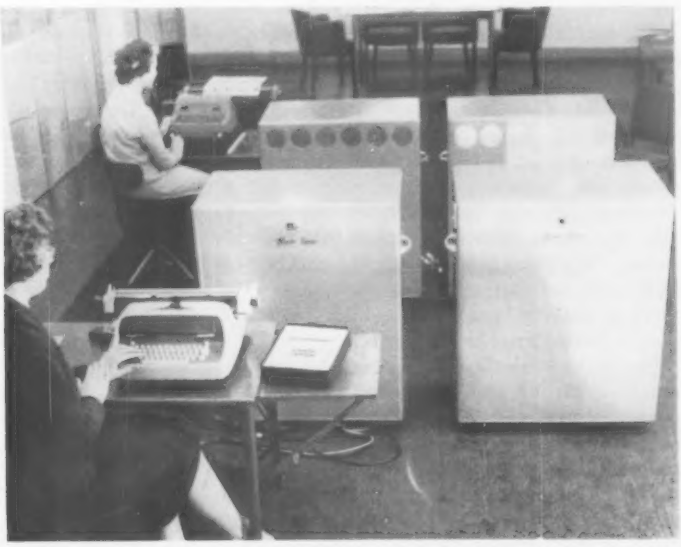
Keys are also provided to permit program tabulation. This ensures that entries are made in the correct columns—four buttons being provided for pounds, two for shillings, and two for pence. (The maximum capacity of the machine, modifiable to customer requirements, is £100,000). Should any error occur in entry, the machine will detect it and stop automatically.

The channel selector divides the time of the calculating unit between the various outstations, thus allowing up to five to be on line at the one time. Provision is made to prevent one machine from 'hogging' the calculator. The speed of calculation and switching is so fast that with five machines on line the delay in calculation on the last machine would be not more than two seconds.

The unit has been designed for growth; that is to say, the calculating nucleus and two outstations will provide an economic break-even; the unit becomes even more economical as further outstations up to five are added. In this way various operations within a firm can be systematically brought into the machine's orbit, wages, billing, stock control, etc. In addition such specialised requirements as loan scheduling, stockbrokers' accounts, and financial statistics can be prepared by this method.

The cost of the Banda-tronic, inclusive of the calculating/control nucleus and five outstations, is between £16,000 and £18,000.

For further information tick AO1 on the reader enquiry coupon on page 44, or write to:
Block and Anderson Ltd,
Cambridge Grove,
London, W6.



In foreground, typewriter input/output with buffer store behind; on right, control and arithmetic units.

Low-cost Magnetic Tape Unit

AN answer to the medium-sized customer for whom punched card systems are too slow but conventional high-speed magnetic tape systems uneconomical, may well be a 1401-E data processing system with a 7330 magnetic tape unit, say the manufacturers, IBM. This combined unit has made quite an impact in the middle-price computer bracket in the United States, and is to be marketed in this country by IBM during 1961.

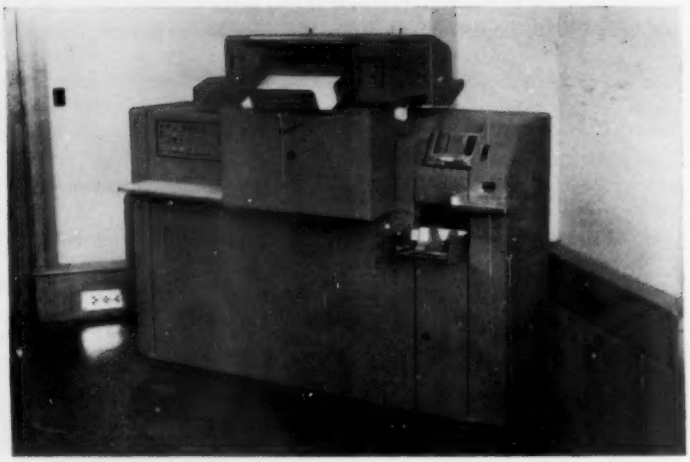
The 7330 is a transistorised tape unit, with complete tape compatibility, and able to accept tapes from other higher speed systems. The tape passing speed is 36 inches per second, which means a read/write speed of 7,200 characters per second when on single density (200 characters per inch) or 20,000 characters per inch on dual density (556 characters per inch). This means, in effect, a read-speed of 20 times that of conventional punched card equipment, and a write-speed of 60 times the equivalent write out on punched card units. The start-stop time of the 7330 is five milliseconds.

Parity checking can be carried out during both read and write operations, using either the vertical check for each column of bits or the longitudinal check for each record. Tapes may be backspaced over a record or rewound to the beginning of the reel; a horizontal tape transporter of simplified design safeguard against tape breakage.

Rental of this equipment is given as £175 per month, some £100 less than the cheapest tape unit in the IBM range, the 729. No sale price is given, though the unit costs 19,000 dollars in the USA.

For further information tick AO2 on the reader enquiry coupon on page 44, or write to:
IBM United Kingdom Ltd,
101 Wigmore Street,
London, W1.

▲ *The duplicator coder*



IPC sits on tabulator ▶

Ledger Posting by Tabulator

DE LA RUE BULL have announced a new ancillary equipment, the IPC, which enables ledger posting and other book-keeping operations to be carried out by punched card tabulators. By this means 1,500 ledger entries can be made in an hour, on standard two-sided ledger cards consisting of 35 lines each of 87 or 97 characters. The makers feel that in this way the continuity of ledger entry can be established, and the peak periods at the end of the month can be avoided.

The ledger sheets are first inserted in a small duplicator coder and the new account number entered on existing sheet number carried forward to the new sheet. The sheets are then fed into the input hopper of the IPC which is attached to the tabulator. The appropriate cards relating to the ledger sheets, and in the same order sequence, are put into the card input of the tabulator. As the card and sheet are fed simultaneously into their respective readers the numbers are compared and, if identical, the sheet is placed in front of the printing device; if the sheet number is lower than the punched card, the sheet is automatically ejected; if higher, the machine stops, and a signal light signifies if the card refers to a new account or missing sheet.

When the sheet comes into front of the printing device the line detector brings the sheet into position automatically on the line to be printed. This is done by means of a perforation made at the side of the sheet as the line is printed, which enables the next feed-in to be positioned at the first available line.

The machine would then read and double-check the old balance card; check the account numbers on the sheets as well as on the cards for comparison; calculate the new balance and check the result, before printing out on the ledger sheet and entering on the new balance card. A final accuracy check is provided by the control balance totals at the end of the positioning.

The machine will turn over the ledger sheet automatically when the page is full and print on the other side; it will also return to the correct position any sheet which has been put in the wrong way round. On completion of the entry the machine will automatically eject the sheets into the outfeed hopper. If a sheet is completed on both sides, but further entries are required, the machine will stop to allow a further sheet to be inserted.

The makers envisage that this system could be used for maintenance of customer accounts, back ledger posting, stock accounting, as well as for comparative statistics in sheet ledger form, sales trends by product, representatives, etc, or changes in cost prices, salary records, and many other applications. One advantage for the smaller firm is that the incorporation of the IPC does not inhibit the tabulator from performing its other routine functions. The machine is designed for use with the Bull tabulator (but could be adapted for use with other similar equipment).

For further information tick AO3 on the reader enquiry coupon on page 44, or write to:
De La Rue Bull Machine Ltd.
114/118 Southampton Row,
London, WC1.

Optical Scanning Punch

AN equipment which is going into active production in Germany and the United States, and which will probably be marketed in the UK this year if suitable adjustments can be made, is Remington Rand's new optical scanning punch. At the moment the only cards that this machine accepts are standard 90-column punched cards, but this incompatibility with current British equipment should shortly be overcome.

The scanner reads ordinary pencil marks, check marks, lines, X-marks and circles, and actual numerals. No special symbols or special magnetic pencil is required. The scanner reads the marks on the card photo-electrically and punches the equivalent code holes into the same card. The output of the machine is given as 9,000 cards per

hour—or 150 per minute—and this figure is maintained regardless of the number of columns to be scanned. The equipment is able to sense 40 columns of the 90-column card, that is to say, 13 columns more than the current maximum on existing units.

High flexibility of programming is possible through the use of manual switches and a removable plug board.

The scanning punch will work in conjunction with Univac Solid State units, and will reduce the time taken on card punching, automatically detecting cards wrongly marked. Manual punching is thus eliminated by this method. Cost of the equipment is given as £5,000 to £6,775.

For further information tick AO4 on the reader enquiry coupon on page 44, or write to:
Remington Rand Ltd,
Remington House,
61-65 High Holborn,
London, EC2.

No 'middleman' equipment needed

Magnetic Ink Tester

THE Whirly-Sig Mark II, an electronic measuring device for ensuring that magnetic ink printed on cheques, etc, is of the quality necessary for machine sensing, is to be marketed by Lamson Paragon Ltd.

The tester consists of a document transporter and calibrated meter for determining the signal level of magnetic ink characters. The printed sample is carried under the sensing heads by the transporter, and the magnetic strength of the printed characters passing under the heads is read on the meter. The reading will be compared with a printed master and any variation beyond the permitted tolerances is immediately apparent.

This equipment should be particularly useful to banks who are likely now to employ magnetic cheque sorting methods, now that the clearing banks have given the 'all-clear.'

For further information tick AO5 on the reader enquiry coupon on page 44, or write to:
Lamson Paragon Ltd,
Paragon Works,
London, E16.

Testing magnetic printing

Ordinary Documents as Computer Input?

A MACHINE which can read direct from a conventionally printed document into a computer is shortly to be marketed in this country by IBM, after its debut in the United States.

This is the 1418 optical character reader, which reads into the core store of a 1401 data processing system, while the computer is performing simultaneously tape-to-printer operations, etc.

The machine is able to read pencil or ink markings, printed data from punched cards and continuous card forms, inprinted charge slips, telephone bills, tax notices and premium notices. It is able to read both standard 407 type (10 characters per inch of .093 inches height) and elongated 407 type (seven characters to the inch of .130 inches height). Considerable flexibility in paper size and thickness can be tolerated by the machine.

Documents to be read are fed continuously to the machine by a nonstop hopper with a capacity of 800-1,500 forms, depending on paper thickness. A program stored in the 1401 regulates infeed to the reader, passing the documents through a separator on to a

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Flexibility in parity checking

revolving vacuum drum. As the drum revolves the document is scanned by the lens of the optical reading station, and removed by a continuous belt into the appropriate outfeed sorter pocket station. The system operates very much like a facsimile system, the reflected light from the document being passed via the lens to a rotary scanning disc, and thence to a photo-multiplier tube. The electrical impulses from the photo-multiplier go to a video amplifier which analyses successive groups of scans into black and white, and as a result a character pattern is matched against an internal logic pattern for one character.

The 1418 has a reading rate of 480 characters per second, and is able to handle as many as 400 documents per minute.

There are two models of the reader, the Mark II model having 13 storage pockets and being able to carry out independent optical sorting when not in use as an input unit for the computer. Rental of the equipment in the United States, which is roughly on a parity with this country, is (converted into sterling) between £900 to £1,000.

For further information tick AO6 on the reader enquiry coupon above, or write to:
IBM United Kingdom Ltd,
101 Wigmore Street,
London, W1.

Paper Tape Reader

A TRANSISTORIZED tape reader, using temperature compensated photo-transistors as sensing elements, is to be marketed by English Electric. The reader has a reading speed of 1,000 characters per second, and can be adjusted to accept standard five-, seven- and eight-hole paper tape.

An important element of the reader is its starting/stopping facility. Starting and stopping can be carried out as many as 30 times per second, and there is no risk of losing a character on re-start, even when the reader has stopped at any character from full speed.

Character reading from the tape can be re-arranged, or selected bits of a character omitted, according to a replaceable plugboard. Repetitive reading is possible, the magazines allowing a 100-foot loop to be so read.

For further information tick AO7 on the reader enquiry coupon above, or write to:
The English Electric Co Ltd,
English Electric House,
Strand,
London, WC2.

IBM 1400 SERIES

TWO NEW ANNOUNCEMENTS

1. RAMAC. The unique IBM RAMAC (Random Access Method of Accounting and Control) is now extended to the computer system that is breaking all sales records—the IBM 1401. RAMAC provides true 'in-line' data processing, allowing transactions to be processed as they occur and in any order. One RAMAC unit, storing up to 20 million alpha-numeric characters, may now be incorporated with the IBM 1401 computer system.

2. IBM 1410. IBM's latest computer in the 1400 series incorporates many of the features that have made the smaller IBM 1401 so successful, plus the storage and processing capacity of larger computer systems, plus RAMAC. The IBM 1410 includes :

* Up to 40,000 positions of immediate access core storage.
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* Up to 20 magnetic tape units. Tape units may be combinations of the IBM 7330, IBM 729 II, or IBM 729 IV.
* 1 or 2 data channels giving information transfer rates of up to 125,000 characters a second.
* Up to 5 RAMAC file units, storing up to 100 MILLION alpha-numeric characters. Each RAMAC unit may have up to 3 access arms.
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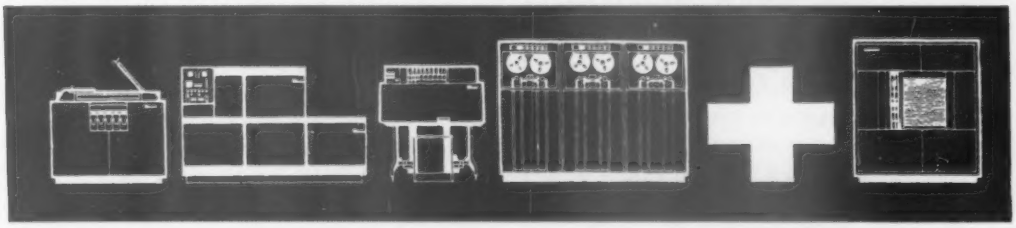

Customers

The following is a list of some of the 75 British organisations that have ordered the IBM 1401 :

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Card System CITY OF PLYMOUTH · COTY (ENGLAND) LIMITED · DURHAM COUNTY COUNCIL · GILLETTE INDUSTRIES LIMITED ALFRED HERBERT LIMITED · JOHNSON & JOHNSON (GT. BRITAIN) LIMITED · MANCHESTER REGIONAL HOSPITAL BOARD · MARS LIMITED · MERCANTILE & GENERAL REINSURANCE CO. LTD. · THE MERSEY DOCKS & HARBOUR BOARD · THE HERBERT MORRIS GROUP PETFOODS LIMITED · WESLEYAN AND GENERAL ASSURANCE SOCIETY · LEYLAND MOTORS LIMITED · THE NORTH WESTERN ELECTRICITY BOARD · GIRLING LIMITED · THE YORKSHIRE INSURANCE COMPANY LIMITED.

For further information, please get in touch with your nearest IBM office, or write to IBM United Kingdom Limited, 101 Wigmore Street, London, W.1

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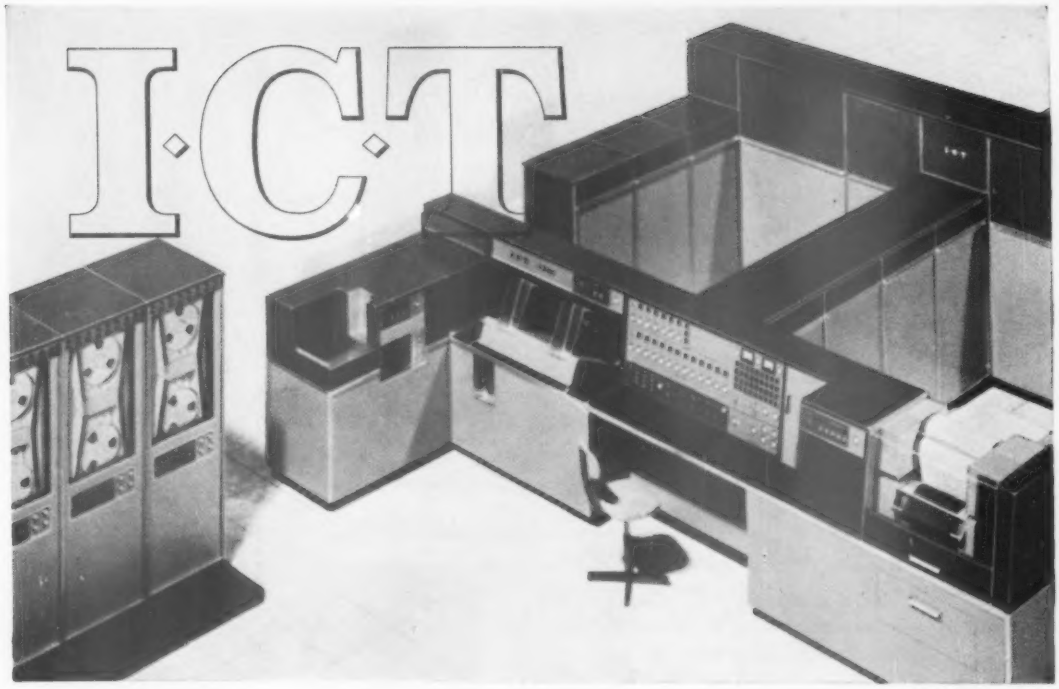

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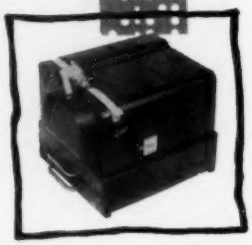

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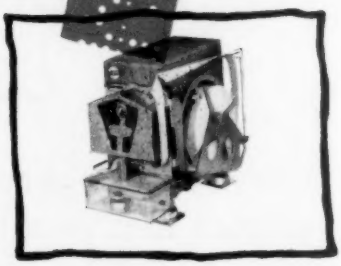

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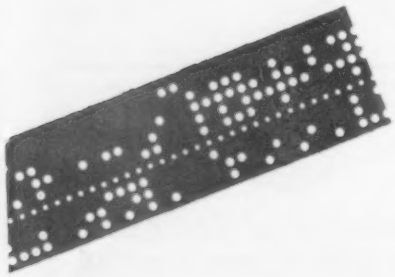

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